

China's AI Adaptive Learning Industry Whitepaper

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Abstract

With the breakthrough from computation power and algorithm capability, Artificial Intelligence ("AI") has been evolving quickly in simulating human intelligence and penetrating multiple aspects of our daily life. "AI Adaptive Learning" is a major achievement after AI is applied to the education industry, which truly helps to implement the teaching philosophy of "teaching in accordance with one's aptitude".

In recent years, China has been encouraging the implementation of digital and intelligent transformation in the field of education. In 2017, the State Council issued the "Development Plan for the New Generation of Artificial Intelligence", which defined the pivotal position of AI in education. Shanghai is one step ahead of the others by issuing the "Shanghai Education Informatization 2.0 Action Plan (2018-2022)" to clarify the future direction of intelligent education, in which "AI Adaptive Learning" was mentioned for the first time.

The market potential of AI Adaptive Learning is growing rapidly with diversified service offerings. Meanwhile, due to the high technical barriers and changing application scenarios, its market definition and user recognition remain unclear. Under such situations, EY-Parthenon publishes this white paper with an analysis on the industry status-quo and future trends. We hope this white paper could help market participants and users get a deeper understanding of AI Adaptive Learning and move the industry forward together.

This white paper will begin with the analysis of the industry status-quo, a definition of the intelligent level, an estimation of the market size of China's K-12 AI Adaptive Learning industry and a summary of key success factors. Furthermore, Online-Merge-Offline ("OMO") business model will be discussed with its background, form and future direction. In the end, we will raise our preliminary thoughts about how AI adaptive learning will evolve from social environment and competition landscape perspectives.

Key insights and findings of this white paper:

- ▶ AI Adaptive Learning refers to the educational products in which artificial intelligence can take charge of the teaching activity to provide students personalized learning experiences.
- ▶ We estimate the China K-12 AI Adaptive Learning market will reach around USD 40 billion (RMB 270 billion) by 2025. The low-tier cities' offline education channel will be the main sub-segment of penetration.
- ▶ The market competition landscape is highly concentrated for now, with more than half of the market share in the hands of a few top players. However, it is also expected that more tech companies, traditional education institutions, and online education platforms will announce their entry into the market in the future.
- ▶ The key success factors of AI Adaptive Learning enterprises are AI technology optimization, content development, and user data accumulation.
- ▶ OMO AI Adaptive Learning is a new exploration direction that can promote deep integration of multi-scene teaching and solve the shortcomings of traditional online and offline education.
- ▶ In the future, China's AI Adaptive Learning industry will show four trends: More traditional entrants, more comprehensive subject coverage, more education stage coverage and more approach oriented.

01

Overview of China's AI Adaptive Learning Industry



1.1 The Development of China's AI Adaptive Learning Industry

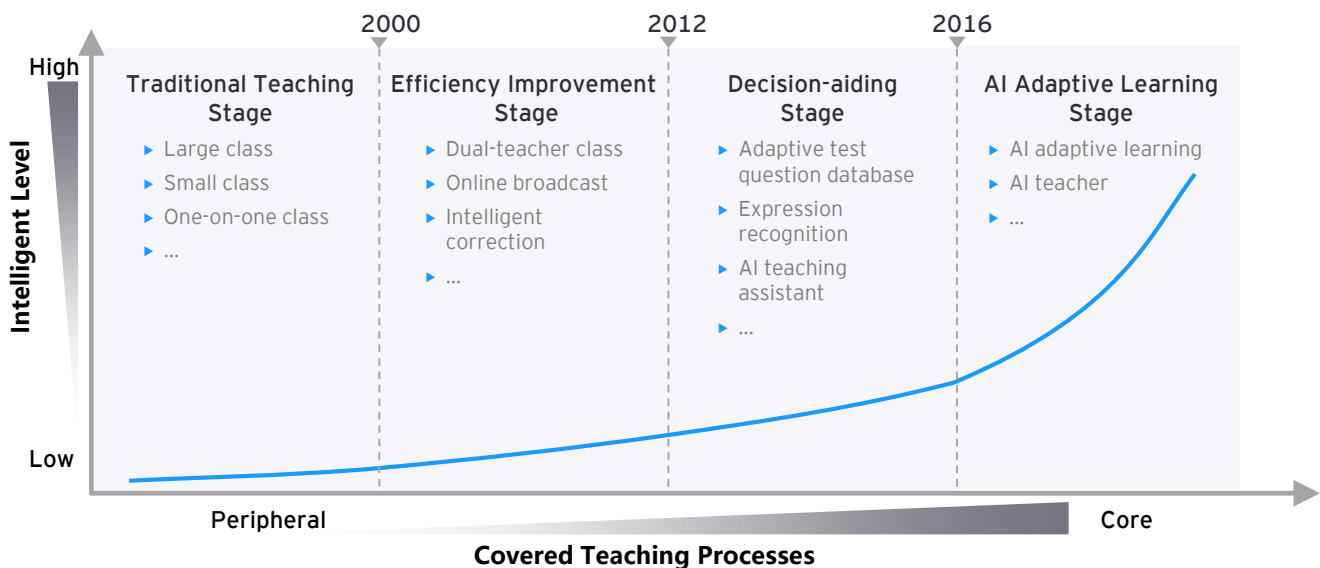
In recent years, artificial intelligence (AI), big data analysis, cloud computing and other emerging technologies gradually penetrated into all walks of life, driving the transformation of our society from the "Internet era" to a new "intelligent era." Meanwhile, AI-empowered application has been put in practice in all aspects of the education industry and evolved from single-scene and single-point teaching tools to educational products that integrate multi-scenes and cover all links, and eventually realizing a personalized and innovative teaching experience.

Under this context, the concept of "AI Adaptive Learning" came into being. AI Adaptive Learning refers to the educational products that are based on the use of intelligent technologies such as AI, big data analysis, and IoT, combined with a large amount of user data, to provide a unique and personalized learning experience for students in accordance with their aptitudes. By simulating the process of one-on-one human teaching, AI Adaptive Learning alleviates the shortcomings of traditional education, such as the inefficiencies in large classes and the high cost of one-on-one teaching.

1.1.1 Development Background

The idea of "AI Adaptive Learning" is derived from "Adaptive Education," both of which adhere to the principle of teaching students in accordance with their aptitudes. Adaptive Education came into the light when programmed learning theory and the teaching machine were introduced in the 1920s. With the development of information technology and the popularizing application of AI in the past years, AI Adaptive Learning had formed when AI was adopted in the core links in teaching.

Adaptive educational products have gone through 4 phases: Traditional Teaching, Efficiency Improvement, Decision-aid and AI Adaptive Learning, during which the level of intelligence has been progressively improved, and more teaching links have been covered.



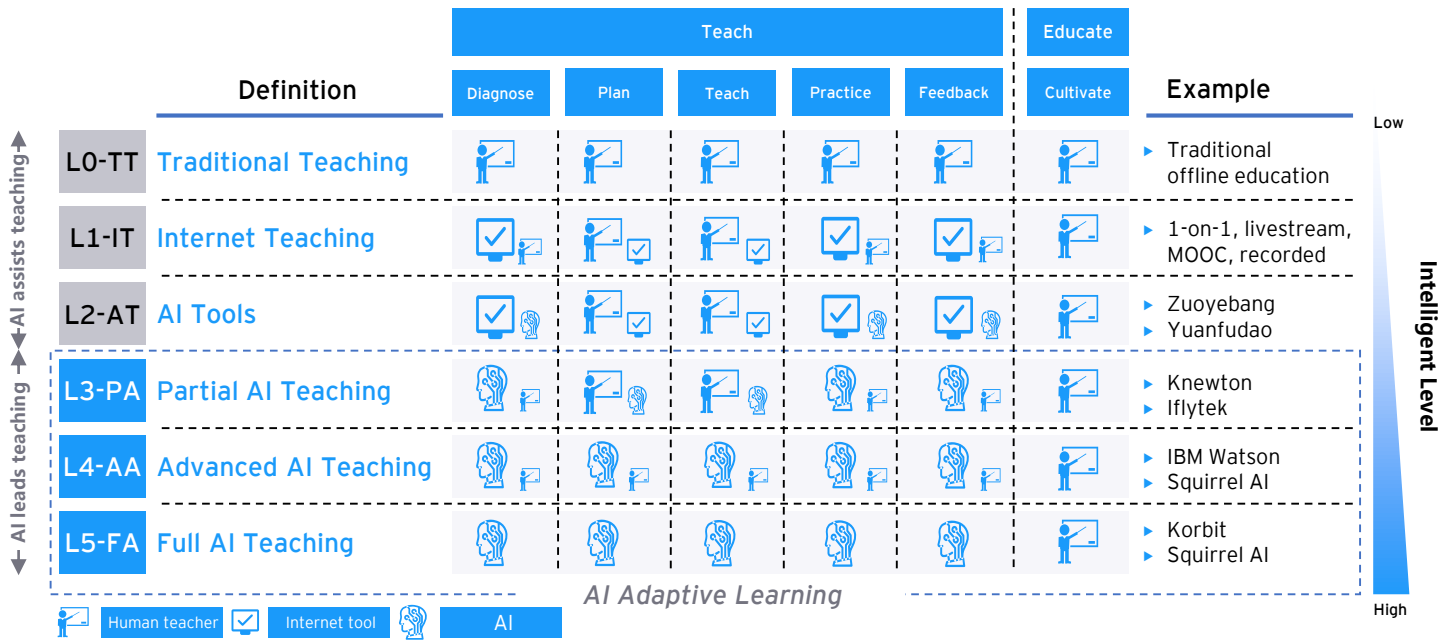
Sources: Deck research, EY-Parthenon analysis

1.1.2 Intelligence Levels of Adaptive Education

According to the degree of intelligence, adaptive education can be ranked into six levels (L0-L5). Only when artificial intelligence enters the core "teaching" link (L3-L5) can it be called "AI Adaptive Learning".

- ▶ **L0 - Traditional Teaching (TT):** Traditional real-person teaching in all links without automation tools.
- ▶ **L1 - Internet Teaching (IT):** Human-led teaching in all links, with the addition of digital systems such as online testing, remote platform, etc. to improve teaching efficiency. Representative forms include online live classes, MOOCs, etc.
- ▶ **L2 - AI Tools (AT):** AI has been applied in some non-teaching links to further improve the efficiency, such as photo search, voice testing etc., but the teaching is still led by real teachers. Representative products include Zuoyebang, Yuanfudao etc.
- ▶ **L3 - Partial AI Teaching (PA):** AI was adopted in the teaching process to provide systematic analysis and recommendation to assist teachers in decision-making, but the teaching process was still dominated by human teachers. Companies usually offer a complete set of teaching solution, typically named AI-assisted platform or AI assistant, achieve full-process teaching data access and diagnosis before-, during- and after-class. Representative companies include ALEKS, Knewton, Coursera, Khan Academy abroad, TAL and iFLYTEK in China.
- ▶ **L4 - Advanced AI Tutoring (AA):** AI is adopted in the teaching link, and it leads the whole education process. Students receive education from AI teachers on terminal devices, while real teachers are responsible for final checks and correction. These products are typically named as AI Adaptive Learning Platform or AI Teacher. Representative companies include IBM Watson, BYJU'S, Realizeit abroad, and Squirrel Ai in China (some product lines include real teachers).
- ▶ **L5 - Full AI Teaching (FA):** It is the ultimate form of AI Adaptive Learning. At this level, AI can fully simulate the teaching process of excellent human teachers without intervention. The current international representative is Korbit, an online AI Adaptive learning platform founded in 2018. It was born out of the artificial intelligence lab led by Yoshua Bengio, a Turing Award winner and renowned AI professor. This platform can automatically teach courses including data science, machine learning and artificial intelligence. Squirrel Ai, a leading enterprise in the industry, has also achieved the L5 level with some product applications (such as AI Foundation Courses and free courses partnered with Ding-Talk) with the wide application and fruitful data retrieved from China K-12 education adoption.

It is worth noting that though, in theory, AI can simulate or even surpass excellent teachers, and be applied to all aspects of education, we believe that under current AI's technical level, it cannot replace the role of real teachers in supervision, communication, motivation and personality training. Therefore, it might be an ideal form of education to have AI responsible for teaching and real teachers for cultivating. Looking beyond, with the technological breakthrough, it is not ruled out that there will be a higher level of intelligence that can independently complete all the work of teaching and cultivating.



Sources: Deck research, Interviews, EY-Parthenon analysis

1.1.3 Overseas AI Adaptive Learning Market Overview

With the rise of big data, AI and other technologies, AI Adaptive Learning has moved from theory to practice. In the early 2000s, the first AI adaptive learning product was born in the United States. Companies such as Knewton, Realizeit have come into the public's attention, which marked the start of AI Adaptive Learning in commercial uses. The Indian market began to emerge in 2010, with a few start-ups came to light. At present, due to the variance in teaching content, technical level, and cultural background in different countries, market development diverges as well.

United States: Pioneer in AI Adaptive Learning with mature technical background, excellent content, and clear IP rights. However, due to the multi-race, diverse student background, academic performance is not the greatest indicator of education, it is difficult to realize large-scale To-C promotion of AI Adaptive Learning products. At present, the AI adaptive learning products in the United States are mainly focused on K-3 preschool education and higher education. However, due to inability to realize large-scale monetarization, a number of market players have been acquired by large publishers. A representative of such is Knewton.

Europe: started later than the United States but has a similar level of the research base. Whereas, due to the complex language background in Europe, To-C business is also hard to achieve on a large scale. Limited by the narrow domestic market, many European market players have entered the U.S. market by cooperating with American universities, among which a representative is Realizeit, an AI Adaptive learning platform enabler-

India: the last to enter the game, but due to India's large population, the popularity of Internet, unified K-12 content and urgent demand for good grades, the development of AI adaptive learning products in the Indian market has achieved large-scale promotion, primarily towards K-12 students. At present, India is the most similar AI Adaptive Learning market to China, among which the classic representative is Byju's.

Case Study of BYJU'S

1. Background

As a leading company, BYJU'S was founded in 2011 aiming to provide students with an online learning application covering math, physics, chemistry and biology as well as standardized test such as JEE, NEET, CAT, IAS, GRE, and GMAT. BYJU'S main products are Early Learn App for G1-G3 students and The Learning App for G4 - G12 students.

2. Features

As one of the most popular learning APP in India, BYJU'S major target user is individual students, dedicated to promoting students' autonomous learning in their spare time. The product's most prominent feature is its exquisite videos.

Based on students' proficiency and aptitudes, BYJU'S produces 5-minute videos for each knowledge point and reorder them to provide customized learning paths. In terms of business model, BYJU'S provides free courses at the beginning, then charges afterwards. This way, it can cultivate users' behavior and bring in large amount of registered users.

3. Accomplishments

To date, BYJU'S has accumulated 75 million registered users, covering 1,701 cities, and is one of the largest online education company in India. It has extended its partnership worldwide. BYJU'S is currently valued at USD 10.8 billion, with 19 financing projects completed, accumulating to a total of USD 2,688 million, of which are many well-known PE/VCS such as Sequoia Capital, Tencent, etc.



Sources: Tianyancha.com, BYJU'S Website, Desk Research, Interviews, EY-Parthenon analysis

1.1.4 Major Application in China

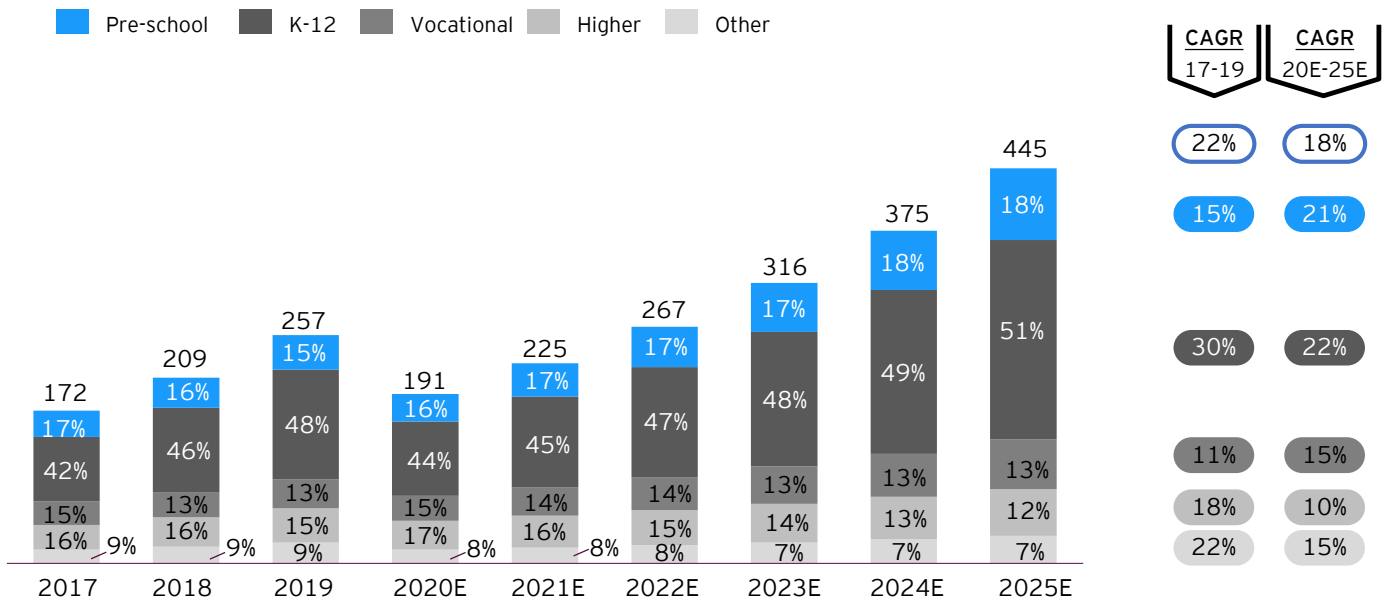
Due to the different educational cultures between China and the U.S., the areas of application are quite different even though China's AI adaptive learning industry bought lots of experience from US in the early stage. In China, the major application area focuses on the K-12 education, mostly due to two reasons:

- ▶ Compared with the other education segments, K-12 education in China is more exam-oriented and knowledge point driven. As a result, students' learning effects are quantifiable, making K-12 education the best landing point for initial application. While education in US focuses more on the thinking process than pure knowledge input, leaving little room for the application of AI Adaptive Learning.

- ▶ China's K-12 education is closely tied to Gaokao (the college-entrance exam), which leads to a higher willingness to pay for K-12 education from Chinese parents. EY-Parthenon estimates the size of China's overall education market has been growing steadily at a CAGR of 22% in recent years. Meanwhile, K-12 education outgrows at a CAGR of 30% among other sub-segments. Long-term speaking, although the overall education market shrunk in 2020 due to the COVID-19 outbreak, we remain optimistic that the market will soon recover, with K-12 education still being the fastest growing.

China's Education Market Size

Unit: Billion USD



Sources: Deck research, Interviews, EY-Parthenon analysis

Note: The figures are converted from RMB into USD according to the exchange rate of RMB against USD (647:100) on February 18, 2021

1.2 Market Size of China's K-12 AI Adaptive Learning Industry

As mentioned above, China's K-12 AI Adaptive Learning industry is undergoing a period of rapid development. Many existing players and new entrants are sparing no effort to conduct quick entry and business monetization in this market.

1.2.1 Market Size of China's K-12 Education

China's K-12 education market can be divided into online and offline channels. The offline market is formed by traditional education institutions, offering face-to-face teaching. The online market is an emerging market generated by moving part or full of the teaching activity online in recent years.

The offline education market is the main battlefield of K-12 education institutions traditionally. We estimate the offline education market has reached approximately USD 115 billion in 2019, attributable to the following driving factors:

- ▶ **Demand side:** Chinese households' disposable income continues to rise, and the consumption of educational products is also growing, driven by traditional channel preference.
- ▶ **Supply side:** Education institutions began to focus on low-tier cities, the potential demand for high-quality educational recourses in the sinking markets is further released.

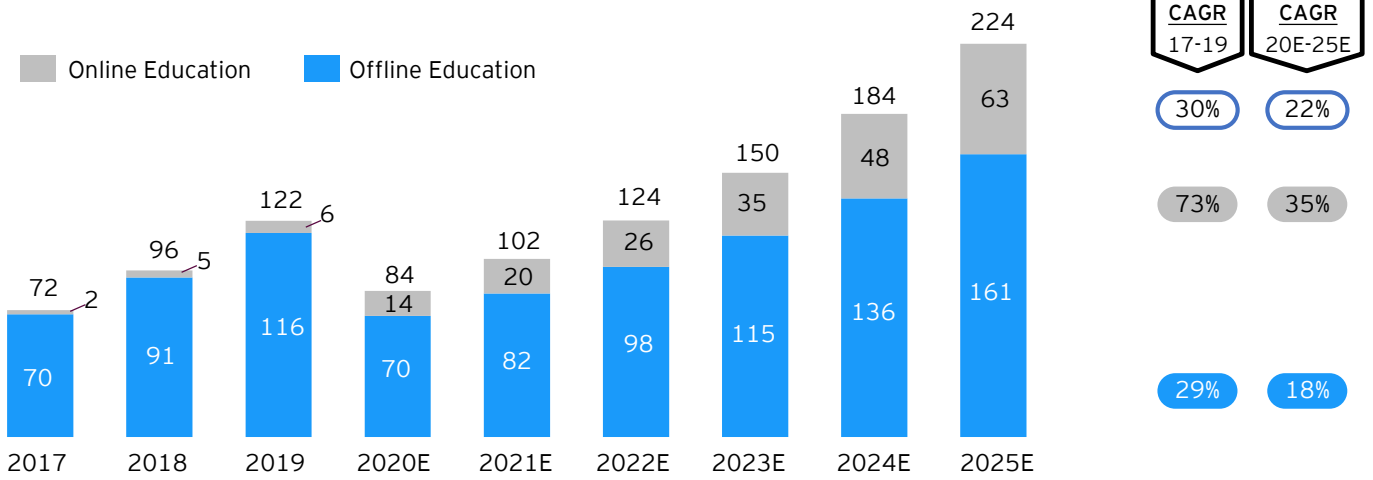
Compared to the offline education market, the online market is a relatively new and small market, derived from the digital transformation of K-12 education in recent years. It is estimated that the size of China's K-12 online education market is expected to reach 63 billion by 2025 at a CAGR of 35%, with the following key drivers:

- ▶ **Demand side:** the problem of unequal distribution of educational resources in different regions has long existed. Online education products have effectively solved the pain point of the lack of high-quality educational resources in remote and rural regions.
- ▶ **Supply side:** the launch of many online educational products has transformed the traditional teaching scenarios, breaking through the limitations of time and space in offline education and bringing new opportunities.

We believe the offline market will still be the main battlefield of K-12 education in the long run, which can be referred to from what happened in the retail industry. The online retail business has shown explosive growth in the past decades. However, according to the National Bureau of Statistics, its proportion in the total sales of consumer goods only accounts for 25% of consumption made offline. The main reason is that online retail cannot make up for the same consumer experience offline. Similarly, in the education sector, customers will pay more attention to the teaching experience when choosing the best education product. Offline teaching tends to be more effective by offering direct interaction, supervision and motivation, thus offline education will remain the first choice for parents and students.

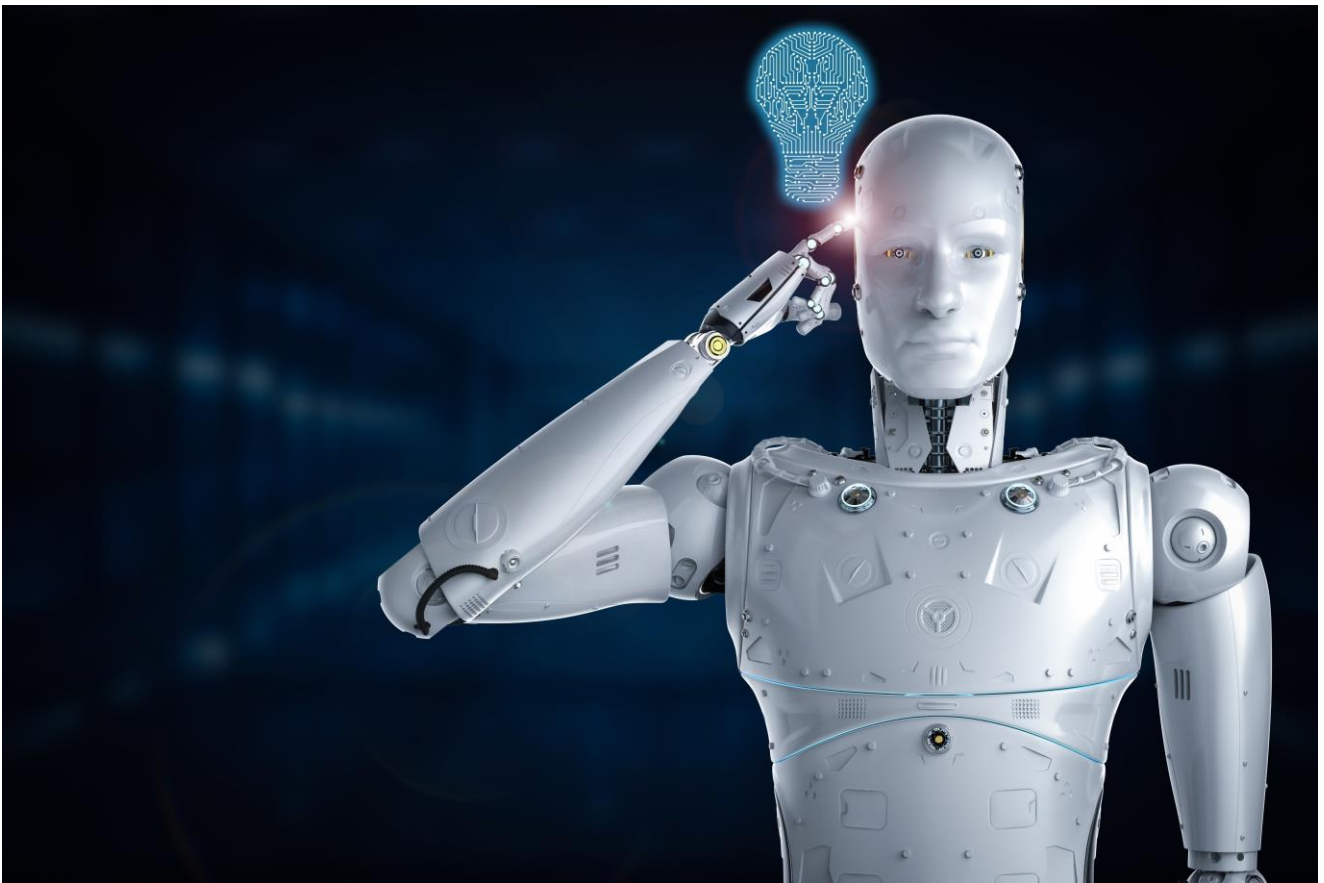
China's K-12 Education Market Size

Unit: Billion USD



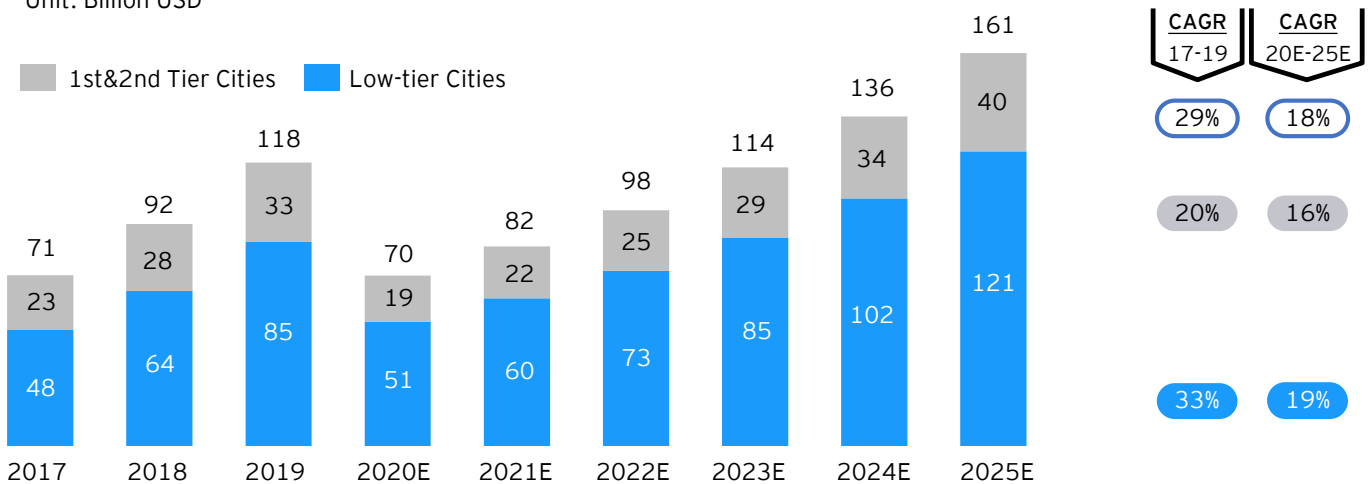
Sources: Deck research, Interviews, EY-Parthenon analysis

Note: The figures are converted from RMB into USD according to the exchange rate of RMB against USD (647:100) on February 18, 2021



China's Offline K-12 Education Market Size

Unit: Billion USD



Sources: Deck research, Interviews, EY-Parthenon analysis

Note: The figures are converted from RMB into USD according to the exchange rate of RMB against USD (647:100) on February 18, 2021

Taking a closer look of the K-12 offline education market from the city levels, it is found that more than 70% of the market is concentrated in the low-tier cities, reaching a scale of USD 1.5 billion and a CAGR higher than that of first- and second-tier market with the following key drivers:

- ▶ **Demand side:** according to the National Bureau of Statistics, there are 180 million primary and secondary school students in China, of which more than 70% come from low-tier cities. The huge student base lays the foundation for the market prospects.

- ▶ **Supply side:** EY-Parthenon calculates that the current share of large education institutions in the lower-tier market is only around 2%. Facing market saturation in first- and second-tier cities, more and more of these players begin to explore into the low-tier cities to maintain their growth momentum, which will bring a new round of upgrade.

Greater market potential of China K-12 offline education can be found in low-tier cities, which implies that how to compete for these students and lay out an efficient route will be the key strategic direction of market players in the near future.

1.2.2 Market Size of China's K-12 AI Adaptive Learning

EY-Parthenon calculates the market size of China's K-12 AI Adaptive Learning industry which has reached **USD 4.6 billion in 2019 and is expected to reach USD 40 billion by 2025 at a CAGR of 62%**. Our projection is based on the following factors:

- ▶ **Policy: National and local policies have continually defined the strategic positioning of AI Adaptive Learning.** At the national level, the State Council issued the "New Generation Artificial Intelligence Development Plan" in June 2017, proposing a new education system that includes intelligent learning and interactive learning and promoted the application of AI in the full process of teaching, management and resources construction, bringing AI education to a national strategic level for the first time. In April 2018, the Ministry of Education issued the "Action Plan for Educational Informatization 2.0" to vigorously promote intelligent education, carry out the construction of intelligent teaching environment, and promote the application of artificial intelligence in education. On a local scale, in September 2018, the Shanghai Education Commission issued "Shanghai Education Informatization 2.0 Action Plan (2018-2022)", which suggested "to explore new education form based on Knowledge Graph and AI adaptive technology, and to create unified-standards shanghai solution to crowdfund and crowdsource academic resources. This plan explicated the explorative direction of AI Adaptive Learning.

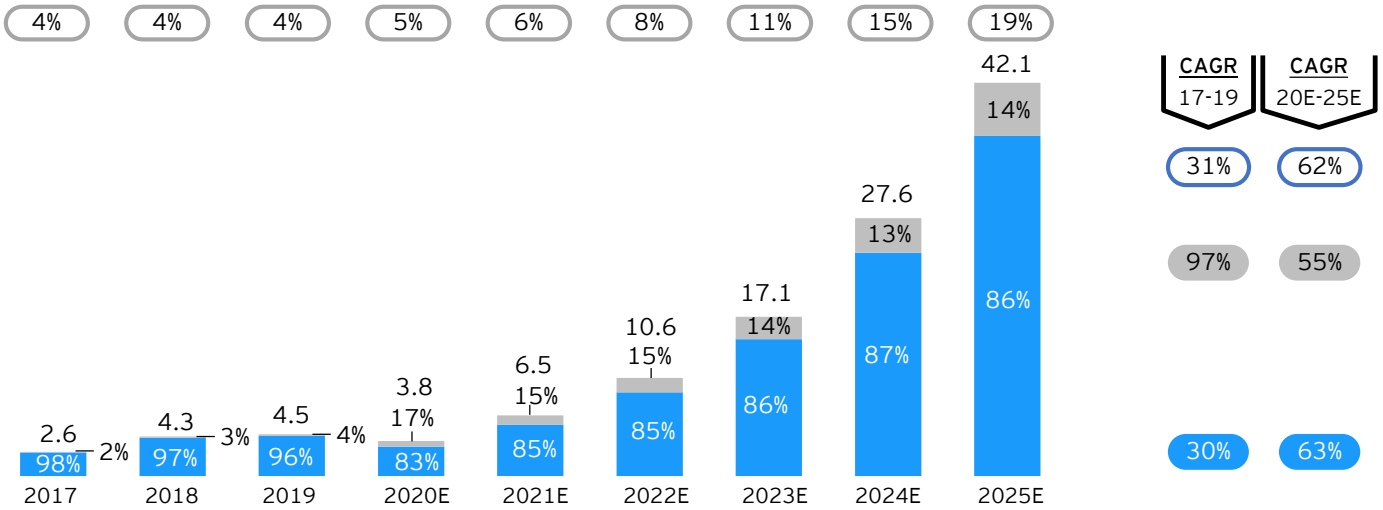
- ▶ **Technology: the development of hardware and software had improved the application effect of AI Adaptive Learning.** In recent years, the performance of computing chips has greatly improved on the cost-effectiveness, which provides the foundation for wide application of AI Adaptive Learning. With the advancement of AI, deep learning and algorithm model, AI Adaptive Learning had moved from a theoretical level to practical application. Besides, the high-quality labelled data gradually accumulated during the interaction between user and application process, which further improves the algorithm accuracy and enables the product effect to be proved.
- ▶ **Supply: the intensified competition in the education industry has enhanced the cost-reducing and efficiency improving features of AI Adaptive Learning.** In recent years, with the entry of more online players, the traditional education industry has been abundant with more novel product forms and business models, leading to a more competitive market. AI Adaptive Learning technology, aiming at replacing human teachers, can be a way to reducing cost and improving efficiency for institutions, and additionally, providing differentiated features in terms of customer acquisition and teaching.

China's AI Adaptive Learning Market Size

Unit: Billion USD

■ Online Education ■ Offline Education

Penetration of Intelligent adaptive education:



Sources: Deck research, Interviews, EY-Parthenon analysis

Note: The figures are converted from RMB into USD according to the exchange rate of RMB against USD (647:100) on February 18, 2021

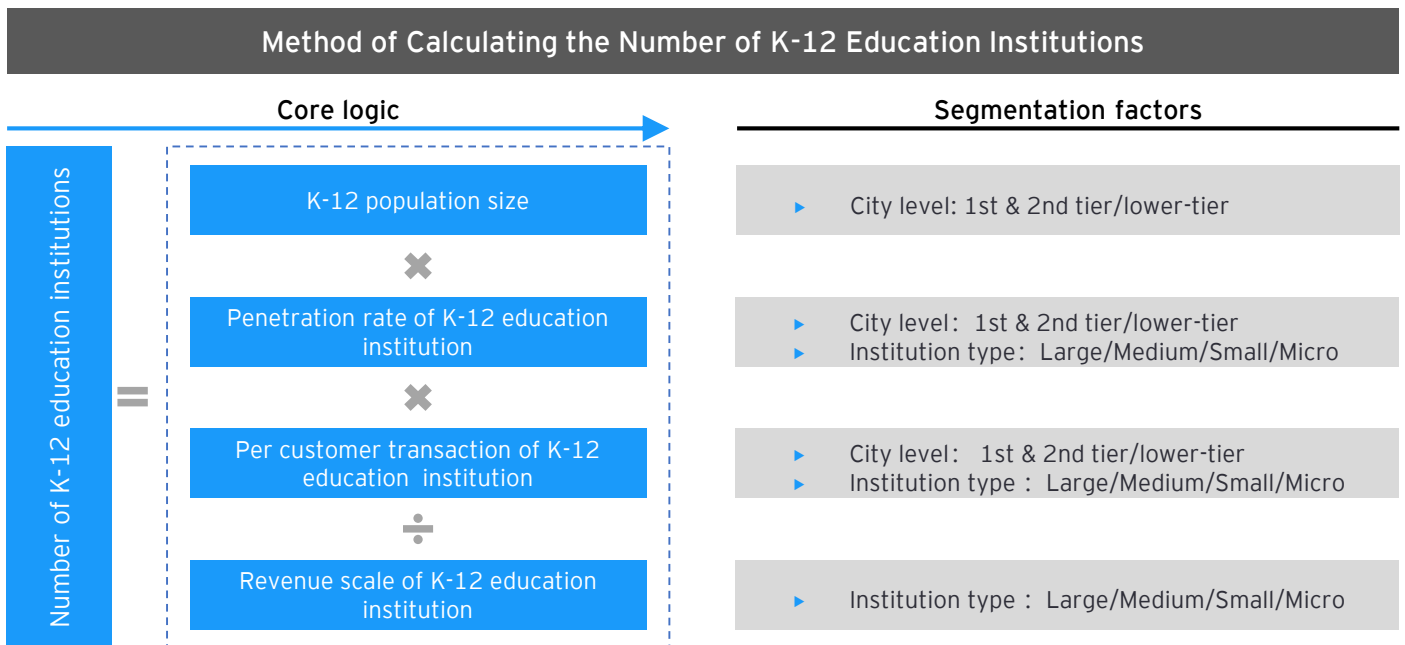
We foresee the penetration rate of AI Adaptive Learning products in **China's K-12 education market will increase from 4% to 19%** in the next five years with a faster penetration rate in the offline segment compared to online. By 2025, **the offline market is expected to account for 86% of China's K-12 AI Adaptive Learning market**, mainly because of the huge

base of K-12 offline institutions in low-tier cities and their high demand for AI adaptive learning solutions. On the other hand, the high customer acquisition cost in the online channels makes fewer players put the online channel as their major focus.

1.2.3 Penetration Trends of AI Adaptive Learning in K-12 Education

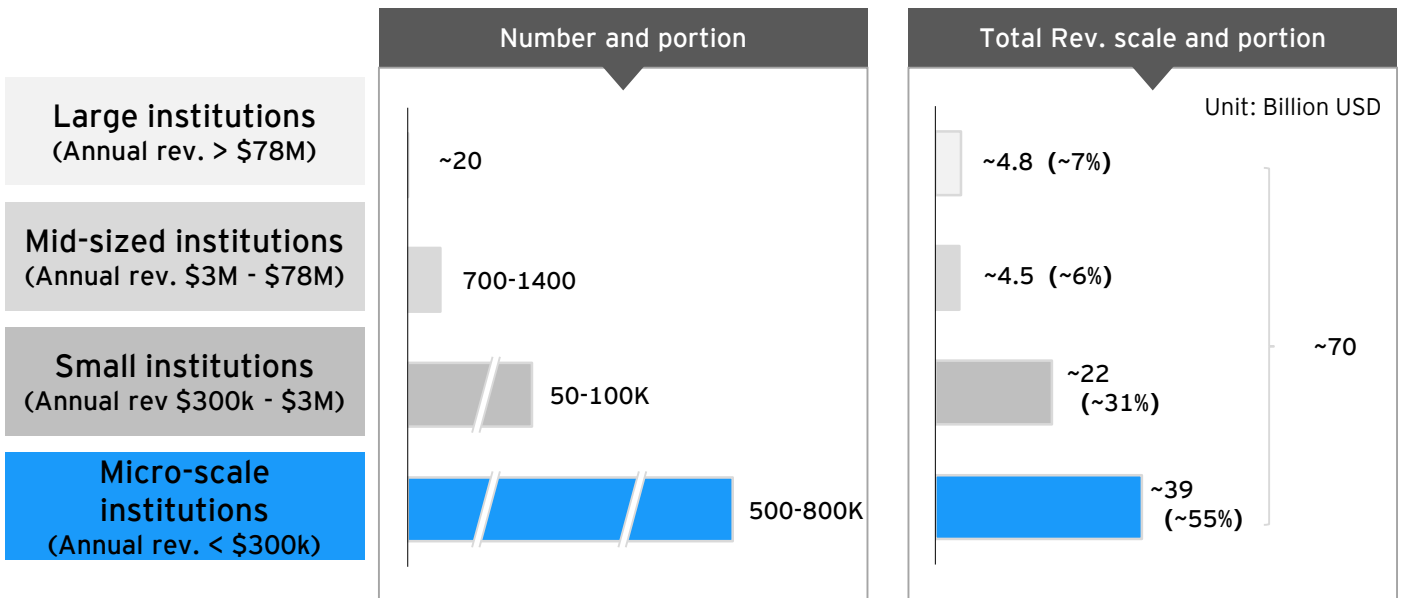
In order to analyze the route of AI Adaptive Learning's penetration into the offline channel, we pursued further analysis of the penetration rate in the offline segment by different types of offline institutions.

Based on China's K-12 population, EY-Parthenon first estimates the quantity of K-12 education institutions in China, considering the adoption rate, annual tuition fee and revenue scale of K-12 education institutions in first- and second-tier cities. It is estimated that there are around 1 million K-12 education institutions in China: 500,000 to 800,000 institutions with an annual revenue less than USD 30 thousand, followed by 50,000 to 100,000 small institutions with an annual revenue between USD 30 thousand - 3 million and 700 -1,400 medium-sized institutions with annual revenue between USD 3 - 75 million. There are only 20 large-scale institutions with annual revenue above USD 75 million in China, accounting for about 0.1% of the market.



Sources: Deck research, Interviews, EY-Parthenon analysis

Number and Revenue Scale of China's K-12 Education Institutions

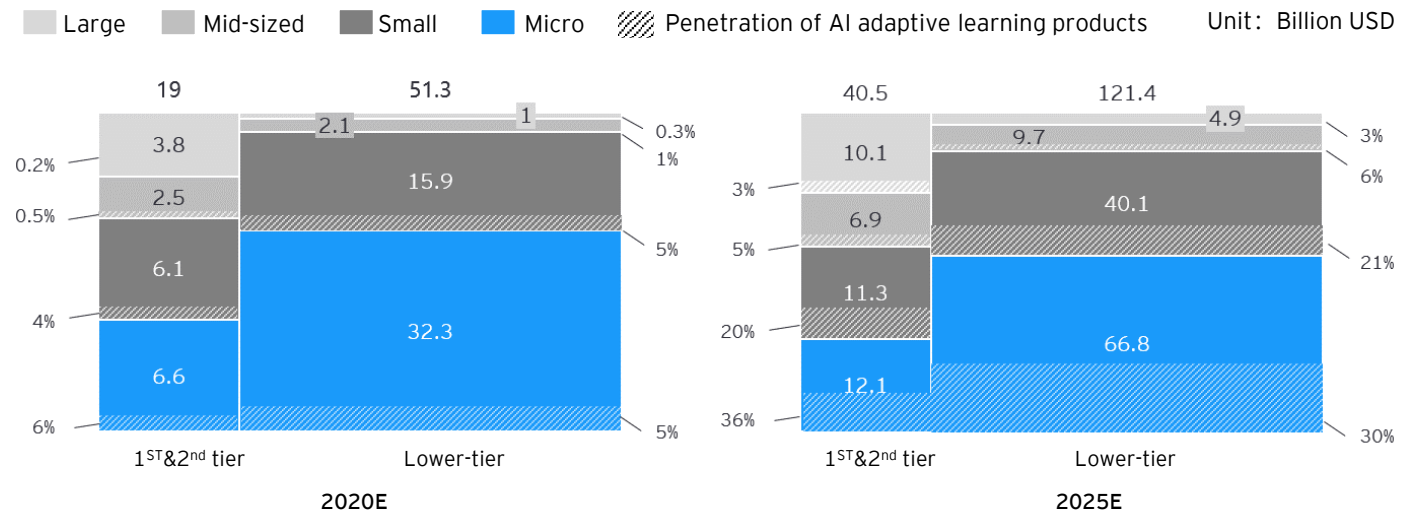


Sources: Deck research, Interviews, EY-Parthenon analysis

Note:

- 1) The number of institutions is calculated by brand, that is, if there are multiple branches under the brand, it is calculated by one.
- 2) The figures are converted from RMB into USD according to the exchange rate of RMB against USD (647:100) on February 18, 2021

Penetration of AI adaptive learning in China's K-12 Offline Education Institutions



Sources: Deck research, Interviews, EY-Parthenon analysis

Looking into the penetration of AI Adaptive Learning products of different city tiers, EY-Parthenon found that low-tier cities will be the focus of penetration in the future due to the following reasons:

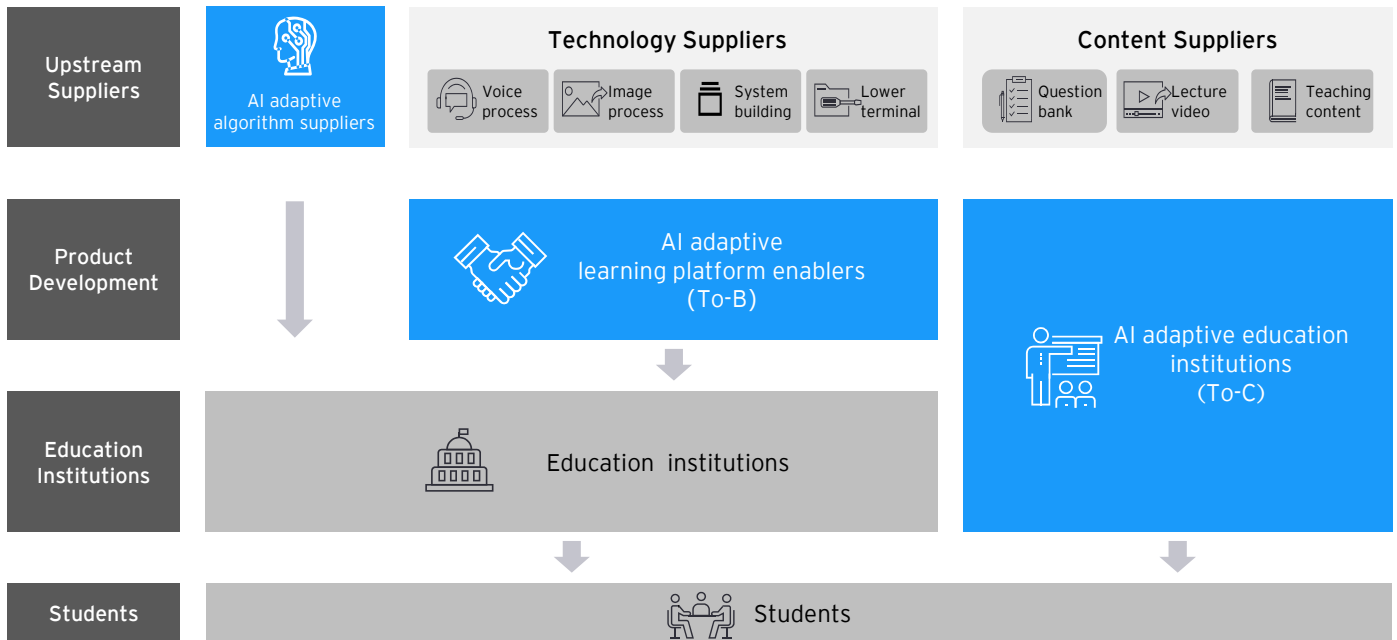
- ▶ **The lack of high-quality educational resources in low-tier cities can be effectively alleviated through the introduction of AI Adaptive Learning products.** The greatest dilemma faced by education institutions in low-tier cities is the lack of excellent teachers, which could be replaced by AI Adaptive Learning products to solve the pain points.
- ▶ **The education expenditure level in low-tier cities is limited, and AI Adaptive Learning products with higher cost-effectiveness are more likely to be welcomed.** The operating costs of AI Adaptive Learning products are much lower than one-on-one or small-class tutoring no matter it is conducted online or offline, which makes AI Adaptive Learning products cheaper and more appealing to the low-tier demographic.
- ▶ **As customers in low-tier cities need more time to accept new technologies, higher potential will be inspired along with the penetration in the future.** At present, customers from tier 1 and 2 cities have better access and willingness of adoption to new technologies. However, with more solutions implemented in lower-tier cities, AI Adaptive Learning businesses can bring confidence to the customers there and increase their adoption rate in the long run.
- ▶ **Capability gaps among students in lower-tier cities are larger than higher-tier cities, which gives AI adaptive learning a better chance to show its benefits in “customized tutoring”.** According to the Ministry of Education, the proportion of junior high students entering in senior high school is about 70% in first-tier cities, such as Beijing and Shanghai, while the proportion in low-tier cities is about 50% with some less than


20%. As a result, traditional classroom tutoring cannot meet the needs of every student, but it is exactly what AI adaptive learning is capable of.

Small and mid-sized education institutions are the main users of AI Adaptive Learning products currently, and we predict it will gradually penetrate mid and large-sized institutions in the future:

- ▶ **Small and mid-sized institutions are generally difficult to recruit excellent teachers and develop curriculum systems, which makes them eager to cooperate with AI Adaptive Learning platforms.** Traditionally, small and mid-sized institutions in low-tier cities are more likely to face the problem of teacher shortage and weak curriculum content. Through cooperating with upstream suppliers and apply adaptive content into their teaching, these institutions can build their own competitive advantages to realize brand upgrades.
- ▶ **Traditional large-size education institutions are more cautious in adopting AI adaptive learning, but it will be part of their business portfolio in the end.** Though the giants of traditional education institutions have deployed large R&D resources into AI Adaptive Learning related products, most of them have not yet been mainstream business. There are 2 major reasons behind: 1) Large-sized institutions are mostly located in first-tier and second-tier cities and it has good teacher resources; 2) Most large institutions are directly operated with heavy asset, which is unlikely to have a rapid expansion in short-term. However, when large-sized institutions are ready to penetrate lower-tier cities, we believe they will adopt AI Adaptive Learning as a crucial part of their business to compete in new markets.

1.3 Competitive Landscape of China's K-12 Offline AI Adaptive Learning Industry



 Core players in AI adaptive learning industry

Sources: Deck research, Interviews, EY-Parthenon analysis

1.3.1 Overview of China K-12 AI Adaptive Learning Industry Chain

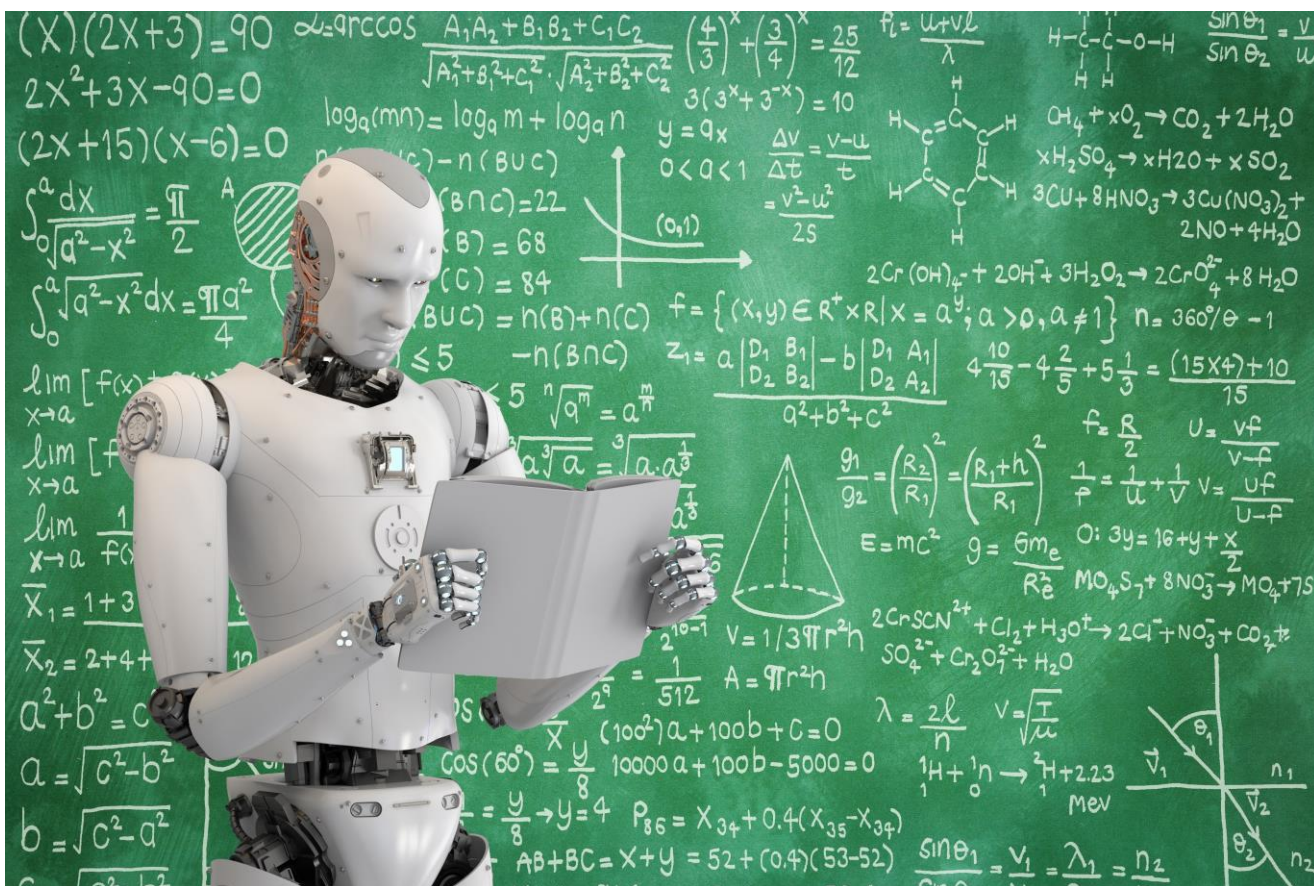
China's K-12 AI Adaptive Learning industry chain can be divided into three parts: upstream suppliers, product development, and education institutions:

- ▶ **Upstream suppliers:** including AI adaptive algorithm suppliers, technology suppliers and content suppliers. AI algorithm providers typically have higher technical advantages, which enables offline education institutions directly. Technology provider includes voice-recognition, cloud service and other application developers. Content publisher provides question databases, teaching videos and materials, etc. Choosing from upstream suppliers could be highly fragmented since the cooperation model will be varying according to different capability distribution among downstream players.

- ▶ **Platform enablers:** providing content and algorithm platforms. Services include knowledge graph development, labelling of knowledge points, and user-data-based AI algorithm development.
- ▶ **Education institutions:** small or mid-sized education institutions are the major customer of platform enablers for now. They get franchised or licensed from platform enablers to get curriculum content, front-end and back-end applications, operating training, marketing support, etc. We also observed another type of full-fledged education institutions that has their own platform for their users.

The core players in the chain are adaptive AI algorithm suppliers, platform suppliers and self-operated education institutions. These players can rely on their own platform to help traditional education institutions or establish their own institutions to serve to the K-12 market.

Meanwhile, most AI Adaptive Learning platforms are adopting B2B business model at the current stage to achieve profitability and gain the first-mover advantage by enabling education institutions with intelligence. Long-term speaking, as the market expands and matures, we can anticipate more players with B2C business models will begin to emerge.



1.3.2 Overview of China K-12 AI Adaptive Learning Offerings

As shown in the figure above, there are two major offering categories of K-12 AI Adaptive Learning in China:

▶ **L3 - Partial AI Teaching:** It uses AI-based tests to conduct a personalized diagnosis before classroom tutoring, and teachers can make lecture notes based on the diagnosis report. During tutoring, the human teacher will lead the teaching activity with support from ad-hoc online personalized exercises to adjust content in real-time. After class, personalized homework with smart correction function will be generated based on student's behavior during class. Homework result will also be shared with the human teacher to provide later explanations to students.




▶ **L4&L5 - Advanced AI Tutoring & Full AI Teaching:** It leverages AI Adaptive Learning system to identify weak link for each student via AI deep learning algorithm, knowledge evaluation method and knowledge tracking theory before class to generate personalized learning path. During classroom tutoring, each student will use handy devices (e.g., AI-integrated machine, PC, Tablets, etc.) to learn based on pre-defined learning path whilst human teacher will be only responsible for the supervision, emotional counseling of the students. After class, the platform will provide personalized exercises to students and intelligent correction functions to human teachers. Some institutions will provide human teachers to answer unsolved questions after-school as a value-added service to improve tutoring quality. Simultaneously, the system will also provide the report to parents which contains multi-dimensional data covering learning, exercise and behavior to generate a comprehensive deep view of their kids.

	Diagnose	Planning	Teaching	Practice	Feedback
L3 Partial AI Teaching	<ul style="list-style-type: none"> ▶ Based on AI competence test, a customized diagnosis is formed 	<ul style="list-style-type: none"> ▶ According to the standardized material and systematic feedback, teachers make lecture notes tuned to the class's level 	<ul style="list-style-type: none"> ▶ Real teachers-led, with intelligent adaptive technology providing learning data to help teachers make decisions 	<ul style="list-style-type: none"> ▶ Personalized question recommendation ▶ Intelligent correction ▶ Teachers provide explanation basing on the class test result 	<ul style="list-style-type: none"> ▶ Analysis of students' learning situation based on small amount of data such as exercises and tests
L4&L5- Advanced AI Tutoring & Full AI Teaching	<ul style="list-style-type: none"> ▶ Based on AI competence test, a customized diagnosis is formed 	<ul style="list-style-type: none"> ▶ The system recommends customized learning path for each student and teachers can tune on such basis 	<ul style="list-style-type: none"> ▶ AI-led, with real teacher responsible for supervision and emotional communication 	<ul style="list-style-type: none"> ▶ Personalized question recommendation ▶ Intelligent correction ▶ Based on each students, AI carry out customized counseling 	<ul style="list-style-type: none"> ▶ Analysis of students' learning situation based on multi-dimensional data of the whole learning process

Sources: Deck research, Interviews, EY-Parthenon analysis

Comparing the two main offerings of AI Adaptive Learning, L3 is an enhancement to traditional education by assisting human teachers. L4&L5 are real game-changers to replace the role of human teachers by letting

“AI” teach, which disrupts our prior acknowledgment to traditional education. The two different starting points lead to differences in depth, coverage and application scenarios of AI technology.

 <p>Technical level</p>	<p style="text-align: center;">L3- Partial AI Teaching</p> <ul style="list-style-type: none"> ▶ Collect fewer dimensional data in small amount ▶ Relatively simple algorithm, uses more recognition AI technology <hr style="border-top: 1px dashed #ccc;"/> <ul style="list-style-type: none"> ▶ Real teachers in core teaching links, assisted by intelligent adaptative tools ▶ Traditional education institutions teaching method <hr style="border-top: 1px dashed #ccc;"/> <ul style="list-style-type: none"> ▶ Schools with sufficient educational resources: full-time schools in first- and second-tier cities and traditional educational institutions 	<p>VS</p>	<p style="text-align: center;">L4&L5- Advanced AI Tutoring & Full AI Teaching</p> <ul style="list-style-type: none"> ▶ Collect multi-dimensional data, covering the whole process of teaching ▶ Involves multi-link data analysis and customized path recommendation, uses more strategy AI technology <hr style="border-top: 1px dashed #ccc;"/> <ul style="list-style-type: none"> ▶ AI-led whole process teaching, with real teachers responsible for support ▶ Mixed-class-mixed-subject method, where students of different levels and subjects can study in one classroom <hr style="border-top: 1px dashed #ccc;"/> <ul style="list-style-type: none"> ▶ Schools lacking educational resources: small and mid-sized educational institutions in low-tier cities
 <p>Teaching mode</p>			
 <p>Application scenarios</p>			

Sources: Deck research, Interviews, EY-Parthenon analysis



1.3.3 Competitive landscape of China's K-12 AI Adaptive Learning

	Market share	Number of players	Company feature
Leading players	~60%	2-3	<ul style="list-style-type: none"> > 2,000 partner institutions Distributed country-wide, with large customer base and revenue scale Strength in technology capability, subject coverage, branding and other aspects, maintain a leading role in the industry
Tail players	~40%	>50	<ul style="list-style-type: none"> < 2,000 partner institutions Started late, mostly start-ups or new business incubated by large enterprises Has not achieved large-scale profit yet, some of which have growth potential due to advantage in niche segment

Sources: Deck research, Interviews, EY-Parthenon analysis

We estimate there are around 50 - 70 K-12 AI Adaptive Learning platform companies in China, with a total of 10,000 franchise or direct-owned institutions. Based on their market share and business scale, we further categorized them into leading players and others:

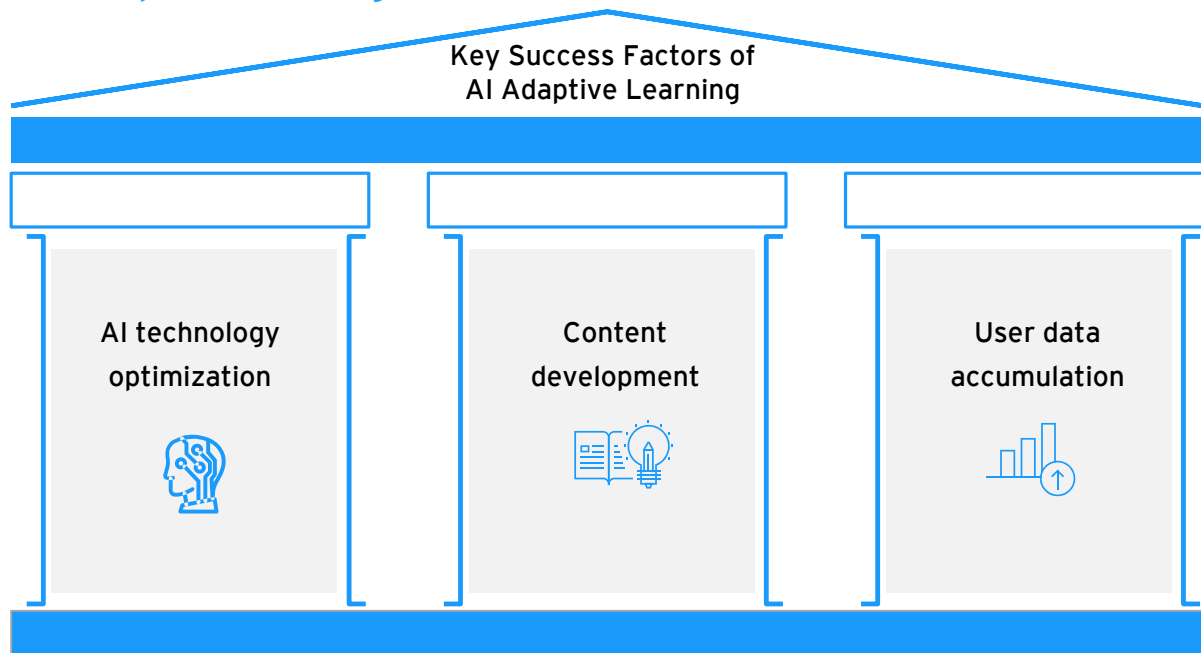
- ▶ **Leading players:** There are only 2-3 institutions with more than 2000 franchise or direct-owned institutions currently, accounting for 60% of the total market. Their institutions are distributed across the country due to their competitive advantages of technical strength, strong subject coverage and brand communication. Squirrel Ai, iFLYTEK are two leading players with their market share still growing rapidly.
- ▶ **Tail players:** most players in this group have dozens to hundreds of institutions for now due to getting into the market relatively late. However, the players can still deepen in their niche market by relying on regional advantages. Backgrounds of these tail players vary from technology companies, online education companies and traditional education companies. They think AI Adaptive Learning could be helpful to enter the market quickly, especially for lower-tier cities. Their solutions are at the early stage and far from scale.

Overall speaking, the current China's AI Adaptive Learning market is highly concentrated (CR2>50% in terms of institution quantity). However, we think the competitive landscape still has the chance to be disrupted in future due to the following reasons:

- ▶ **Rapid market expansion:** AI Adaptive Learning has enormous market potential and its penetration in the K-12 education market is currently low. The large potential for market expansion has attracted players from different industries to enter, resulting in many tail players.
- ▶ **High technical barriers:** AI Adaptive Learning solutions require large investments into R&D and data collection at the early stage due to high capital and talent needs. Tail players still have the chance to set up their own moat if they have the right capability and sufficient investments.

Looking into the future, we expect more emerging players will enter the market due to the further release of demand in the low-tier cities. Particularly, technology companies will leverage their strength in AI technology and enter into the L4 or L5 AI adaptive learning market directly, which may bring more challenges to the current leading players. Tail players without a good business model and enough investments will be difficult to survive in the market. Meanwhile, current leading players may further diverge, with few top players evolving into full-fledged AI adaptive learning providers while others have specific strengths in dedicated areas.

1.4 Key Success Factors of China's K-12 AI Adaptive Learning



Although operating models vary among different AI Adaptive Learning industry players, the key success factors can be summarized in three common elements: AI technology optimization, content development, and user data accumulation.

1.4.1 Key Success Factor 1: AI Technology Optimization

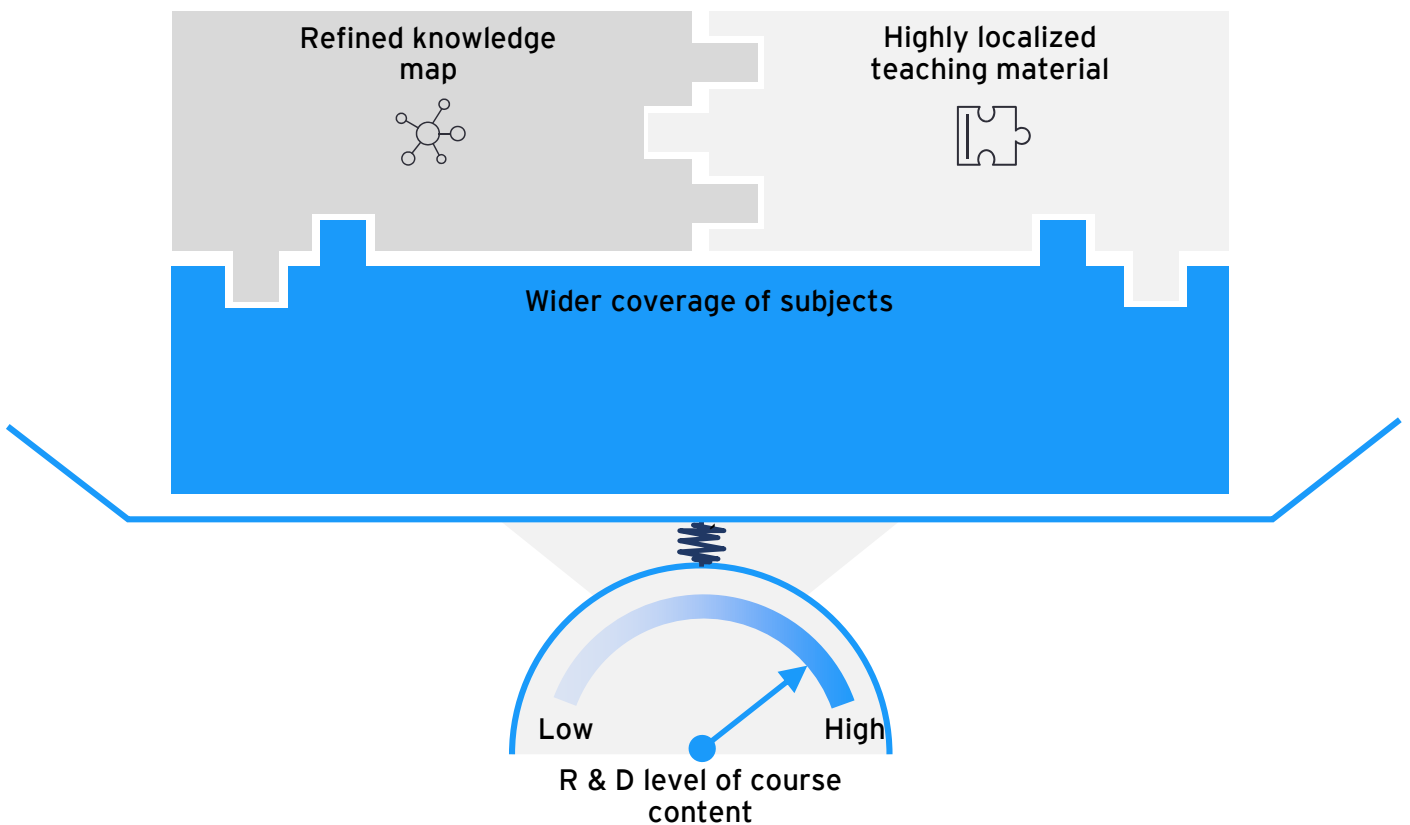
The AI algorithm used by the AI Adaptive Learning system is referred as Strategic AI Algorithm which is different from Recognition AI Algorithm used in face recognition, image recognition, speech detection and other applications and puts forward a stricter requirement for algorithm structure and training. Furthermore, the effect of customized learning diagnosis and learning path planning largely depends on the excellence of the AI algorithm model. For that reason, AI Adaptive Learning players are investing heavily in developing AI algorithm and strive to achieve the optimization of AI algorithm technology with the following key considerations:

- ▶ **Strong and market-leading technical talents:** In the international academic community, the development of frontier AI theory is changing, and the effect is becoming more and more intelligent all the time. Given that AI is a field with high technology barrier, global talents are always in need, and AI Adaptive Learning companies should ensure the strength of their AI R&D team by introducing more talents with diverse academic background and maintain a close relationship with academic institutions to stay ahead in both theoretical and practical means.
- ▶ **Multiple technical routes in AI algorithms to maximize performance:** In the course of years' research of AI Adaptive Learning, many kinds of AI algorithm theories have been formed. Each one is more suitable for solving a specific problem in the teaching process. The practice has proved that there is no one-size-fits-all AI algorithm model for all application scenarios. Under the complex and random scenarios of different students, it may be the only way to realize the ultimate goal of adaptive education by adopting various algorithm models and theories.

1.4.2 Key Success Factor 2: Content Development

Curriculum content development has always been closely linked with the competitiveness of traditional K-12 education institutions. For AI Adaptive Learning players, they should not only know how to teach students with knowledge points, but also how to adapt teaching process

to the algorithm of AI adaptive learning system during curriculum development. In essence, traditional curriculum content needs to be optimized and reshaped, particularly in the following aspects:



- ▶ **Refined knowledge map to maximize personalization:** China's K-12 education system is mostly exam-oriented. The measurement of student's capability highly depends on the mastery of relevant knowledge points. Students cannot get a higher score without the establishment of a complete knowledge graph. Fine granularity of subject knowledge points is essential for an AI Adaptive Learning solution to assess student's capability accurately and provide personalized learning content efficiently. If the content reserve is limited (not enough materials) and the knowledge points are not precise enough (a video corresponds to multiple knowledge points and last more than 5 minutes), there will be only a few fixed learning paths or content to recommend for students, which is difficult to realize the effect of the real customized learning. Therefore, to improve the fineness of knowledge points, some leading companies choose to design nano-level knowledge graph through research and develop related teaching content (such as short videos, animation, etc.) on their own. The whole R&D process involves a large amount of investment and time input but can set up a high barrier and enlarge the gap with competitors once completed.
- ▶ **Highly localized teaching material:** Presently, the industry players develop the teaching materials mainly based on several mainstream versions of textbooks from different provinces in China. However, considering of widely differentiated textbooks and question types among different provinces in China, it will maximize students' learning efficiency if more appropriate teaching materials can be developed to match with their daily-used textbooks.
- ▶ **Wider coverage of subjects:** Current China AI Adaptive Learning players are still fragmented in targeting primary and middle school students, with more focus on science subjects. As a result, many parents need to use multiple platforms at the same time to cover their children's whole learning period, which can be unfavorable to both customer cultivation and customer loyalty. Companies with broader coverage of subjects will get higher customer satisfaction and credits.

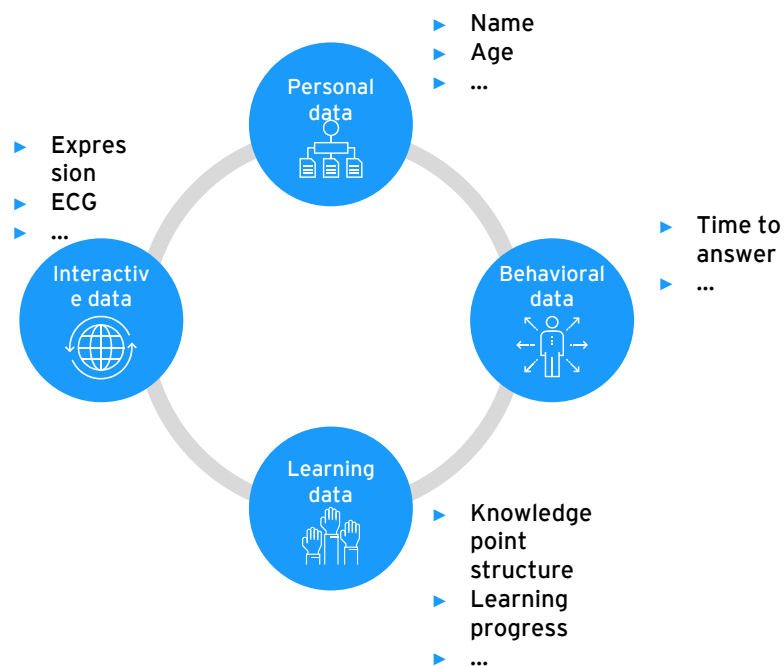
1.4.3 Key Success Factor 3: User Data Accumulation

User data is becoming a common barrier in the digital era, which also works in the AI adaptive learning area. The large amount of student and teacher data generated through teaching activity could lead to a huge competitive advantage in product and operation optimization:

- ▶ **Achieving customized teaching requires the storage of the entirety of learning process data, in which AI Adaptive Learning platform has a natural advantage.** The data set needed for AI algorithm training comes from the whole learning process of each user, including feedback and interactive data between learner and teacher. It helps to generate the portrait of a student in real-time through this continuous and multi-dimensional data accumulation, which helps to predict their reaction and carry out personalized learning path planning. Data collection has encountered stricter policies and regulations nowadays, and the only way for companies to get access to valuable data is through their own products.

From this point of view, platform that wants to build up the competitive advantage should expand their coverage to the whole learning process as soon as possible to start user data accumulation. On the contrary, those question databases and homework apps only have access to student's behavioral data in one learning link, and the static student portrait is difficult for the system to generate real-time interaction.

- ▶ **Proper mining and utilization of user data generated during the application of AI Adaptive Learning can bring great commercial value to the company.** In current AI Adaptive Learning solutions, user data such as personal data (name, age, etc.), learning data (knowledge structure and progress, etc.) and behavior data (time to answer a question, etc.) are mainly used for learning status diagnosis and learning route planning. Other interactive data (e.g., expression, ECG, etc.) plays a supplementary role increasing learning quality. Companies can fully leverage the value via data mining to optimize their product or even monetize the data in cross-industry to bring more value-add to itself.



02

Overview of China's OMO AI Adaptive Learning

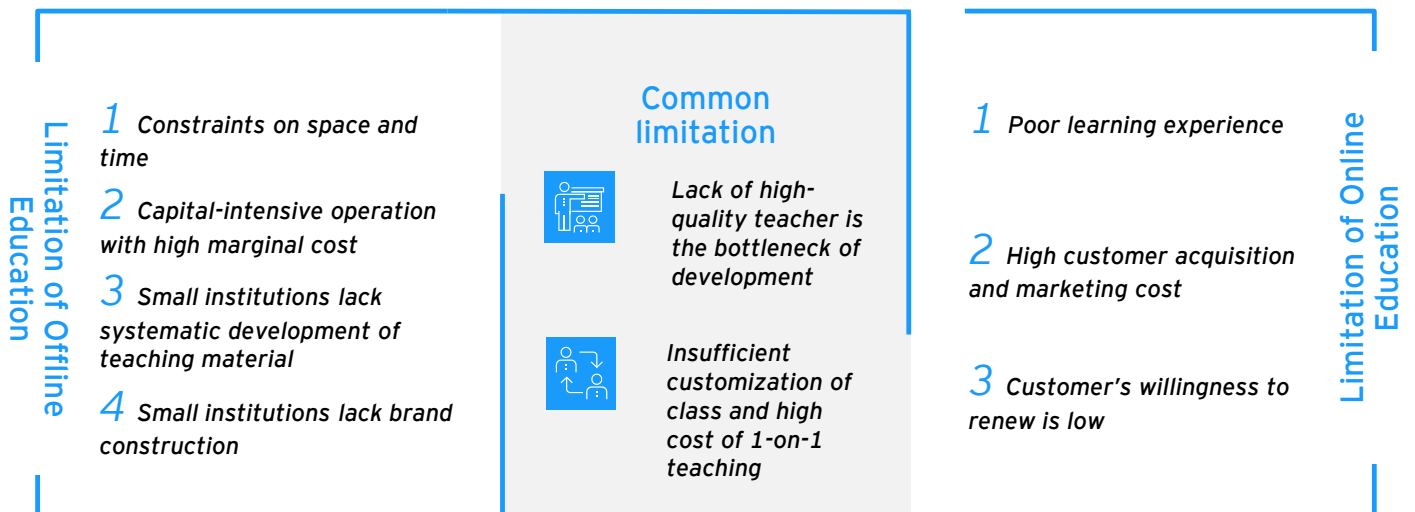


2.1 Background of OMO AI Adaptive Learning

2.1.1 Limitation of Online/Offline Education

Emerging from the wave of “Internet+”, innovative online education modes, such as MOOC and live streaming, have brought disruptive changes to the traditional education industry through a break to the limit of time and space. It was once assumed that the capital-light online business model would certainly overtake, or even replace most of the

traditional offline education. However, offline education has maintained its prevalence throughout the decades since online education, although made up some weaknesses of offline, also has its own limit. In essence, both online and offline education have their own limitation in terms of business model and user experience.

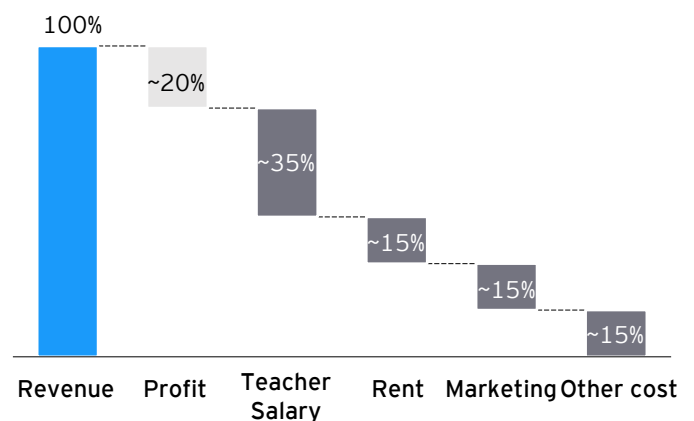


Sources: Deck research, Interviews, EY-Parthenon analysis

- ▶ **Limitation of offline education:**
 - ▶ **Constraint on time and space:** Convenience is one of the main factors considered by parents and students since offline education requires students' physical presence. The demand for short distance and suitable class time leads to a smaller target customer group since only a nearby population can be reached, creating a ceiling for customer acquisition.
 - ▶ **Capital-intensive operation with a high marginal cost:** Offline education institutions usually adopt a capital-intensive operating model, with a large investment in teachers, venues, equipment, etc., making it more challenging for scale expansion with slim profit margin and high marginal cost.
 - ▶ **Small-sized institutions lack systematic development of teaching material:** According to EY-Parthenon analysis, more than 90% of offline education institutions are small and medium-sized players. These institutions usually lack systematic content development methodology, with unstable education quality depends entirely on teachers' own experience, making it difficult to guarantee students' learning effect.

- ▶ **Small-sized institutions lack brand building:** Although the number of small and medium-sized institutions in China's K-12 education market is large, they are too scattered due to the lack of branding, with less attraction to consumers and therefore lower revenue. Non-brand small players are at a significant disadvantage in acquiring customers due to parents/students' preference to brand popularity and reputation. However, brand building takes a long time, and it's challenging to quickly establish trust in a large consumer base. Small education institutions are in urgent need of enhancing their brand influence within a short time.

Cost Structure of K-12 Offline Education Institutions



Sources: Deck research, Interviews, EY-Parthenon analysis



A good teaching content development system should be highly standardized and localized. Only giant educational institutions can realize this. Small and micro training institutions do not have such capability. As a result, in small institutions, teaching quality highly relies on teachers themselves rather than institutions' R&D capability. Once the good teacher leaves, students are easily lost as well.

--Expert from Traditional Offline Institution

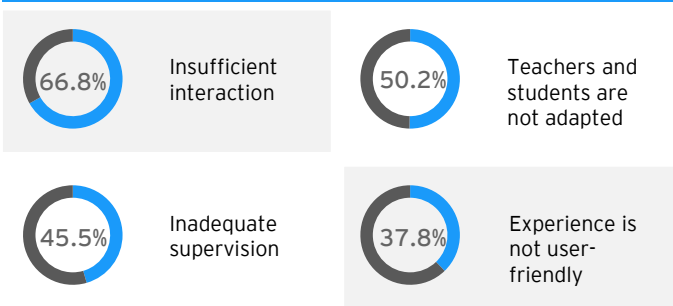
► **Limitation of Online Education:**

- **Poor learning experience:** Student-teacher interaction is limited as students take classes online, which may negatively affect their attention, learning efficiency and class atmosphere. In particular, children in K-12 group have relatively weak self-control and need to form good learning habits under the teacher’s supervision, which is challenging for online education. A survey during the covid-19 pandemic shows that the main drawbacks of online education are related to learning experience, among which 66.8% of users believed that the interaction is limited online; 50.2% mentioned that teachers and students are not quite adapted to the new mode, 45.5% considered online education with insufficient supervision, and 37.8% noted that their online experience is not that user-friendly.
- **High customer acquisition cost:** The development of offline education has slowed down due to the pandemic. Investors’ attention, therefore, shifts to online, with several players gaining colossal finance. Capital-abundant players advertised heavily and launched price-off promotions to achieve rapid growth.

However, due to fierce competition and dissatisfying user experiences, what huge marketing investment generates is not a proportionate growth in customer base but a surge in customer acquisition cost. Research has shown that the current average customer acquisition cost of online education is around 500-1,200 USD per capita, far exceeding the around 80-160 USD per capita for offline. The extreme high cost has a significant negative impact on online institutions’ profit even when they have achieved positive business growth. Most online education companies’ financial reports show that they are actually in a state of loss.

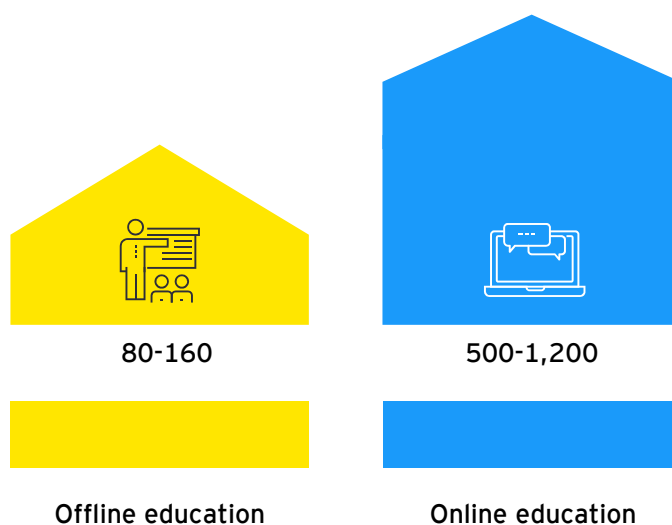
- **Customer’s willingness to renew is low:** User loyalty is usually low in online education due to the dissatisfied learning experience and refund issues related to the crash of some startups. According to an industry insider, the online conversion rate of long-term and regular-priced customer is only 10% - 30%, with a renewal rate of 50% - 80%. How to improve user loyalty is another challenge for online players to sustain their business.

 **Survey on the Shortcomings of Online Education**



Sources: Beijing Normal University’s New Media Research center, Guangming Daily education research center

Customer Acquisition Cost (USD per capita)



Note: customer acquisition cost = (total marketing expense + sales expense) / number of new customers

▶ **Common limitations:**

- ▶ **Quality of faculty is the bottleneck of development:** Teachers play a decisive role in education quality and is also a main consideration for users when choosing education institutions. However, the problem of lacking high-quality teachers had long existed in China. Especially in low-tier cities, outstanding teachers are extremely hard to retain due to poor living standards and employment. According to the National Bureau of Statistics, the student-teacher ratio reached 13 in first-tier cities and 15 in lower-tier cities. Meanwhile, online education is an emerging market with low barriers to enter. The lack of an authoritative teacher certification system negatively affects the overall market reputation, making high-quality teachers less willing to switch to the online platform.

- ▶ **Insufficient customization of class session and high cost of 1-on-1 teaching:** Online and offline share a common principle that more students in the class will bring about a lower price and less customization and satisfaction. Institutions and customers need to trade off between quality and cost, and make choices about class scale among one-on-one, small and large class.



2.1.2 Evolution of Online-Merge-Offline



Industry's exploration of new education model has gone through three stages: Online + Offline (O + O), Online-to-Offline(O2O), and Online-merge-Offline (OMO).

- ▶ **O+O:** Traditional offline education institutions have launched the online business as a supplemental measure amid the internet wave, brings about two types of form. One is "online video class + offline sprint class", which moves part of the standardized teaching content online so that students can learn repeatedly anytime and anywhere, and keep the critical, exam-oriented content offline, to achieve mutual complementarity. The other is "online live class + offline teaching", which was originally developed to reduce the inconvenience of physical attendance but gained unprecedented popularity amid the pandemic. Large institutions provide online classes based on their own platform, while small institutions leveraged third-party teaching tools such as ClassIn. However, in real practice, the online and offline part are simply put together without further integration. Therefore, the offline and online education drawbacks such as time/place constraints and poor learning experience are alleviated but not completely solved. Moreover, the lack of user data integration between online/offline brings further problems such as disparity in a learning schedule, lack of monitoring on students' learning condition, etc.

- ▶ **O2O:** Inspired by the e-commerce Online-to-Offline wave, the O2O tutor platform emerged around 2013. Specifically, it refers to the online third-party information platform which quickly helps to map students with qualified teachers and institutions to solve the problem of information asymmetry between the two sides. Essentially, the O2O platform is an initial exploration of Online/Offline integration, which made some innovation in customer acquisition but didn't change the education mode itself, since teaching process is still conducted offline. Moreover, the market has validated that a direct B-model copy of online food delivery/car-hailing platform into education is problematic because education is a low-frequency business with the careful decision-making. Once users find the right teacher, they can establish a off-platform connection, and the possibility for a second purchase via the platform is low. Therefore, the tide of O2O tutor platform began to ebb in around 2016 when various kinds of players had collapsed one after another, and survivors have embarked on a road of business transformation.

In general, O+O and O2O, as the early exploration made by the education industry, didn't change the education form in essence. With the continual advancement of technology, there's a growing sense that online and offline education needs a deeper integration, which shall achieve immersive learning experience as offline and low-cost, large-scale operation as online.

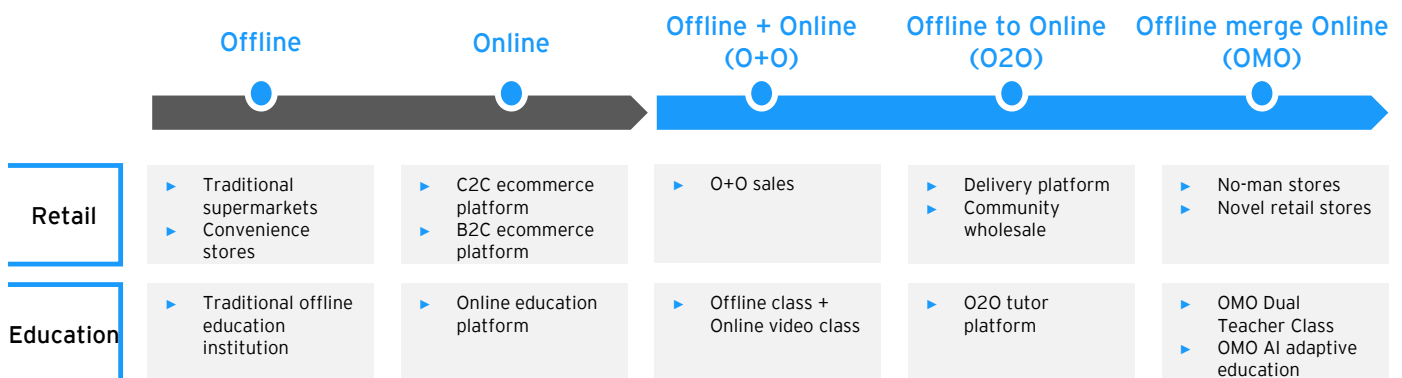
- ▶ **OMO:** The concept of online-merge-offline was first proposed by Dr. Li Kaifu, chairman and CEO of SinoVation Venture, and became widely acknowledged in 2017. It refers to an education mode that can eliminate the online/offline boundary and integrate multiple teaching scenarios and user data by leveraging digital technology. The innovative OMO is expected to achieve better learning outcomes by overcoming the limitation of pure online or offline education, with two sub-modes developed currently: OMO Dual Teacher Class and OMO AI Adaptive Learning:
 - ▶ **OMO Dual Teacher Class:** A new form of education in which students learn in an offline classroom with both remote and on-site teachers. A remote lecturer will teach the content through live/video broadcast while an on-site teaching assistant is responsible for student interaction and classroom order maintenance. The OMO Dual Teacher Class separated the process of “learning” and “practice”, solving teacher shortage in small institutions and low-tier cities, and therefore won great market feedback upon its introduction. Leading players such as New Oriental and TAL entered this market by leveraging their high-quality teacher resource while recruiting many small institutions for local student enrollment and brand promotion. Although this mode effectively alleviated the teacher shortage problem, the lack of qualified teaching assistants could be a new bottleneck, since the industry doesn't have a professional system of training, qualification and career development for them. Meanwhile, class engagement and customization are hard to guarantee since lecturers usually broadcast to multiple classes simultaneously.
 - ▶ **OMO AI Adaptive Learning:** AI Adaptive Learning brings disruptive change to the classroom through digital technologies. The lecturer will be completely replaced by AI, while assistant only needs to maintain classroom order and provide emotional support to students. Compared with the Dual Teacher Class mode, AI Adaptive Learning has fewer requirements for teachers and completely solved the problem of teacher shortage and high labor cost. Through a mix of class and subject, this AI Adaptive mode can further expand the class scale and reduce operating cost, which is hard to achieve in other modes. In terms of teaching quality, AI Adaptive Learning is expected to emulate and even overtake one-on-one tutoring in the long run, reaching the level of “fully adaptive learning” and be competitive in both cost and quality. With advantages in content R&D, AI Adaptive Learning can be fully leveraged by traditional small and medium-sized institutions to solve their brand-building problems.

Limitation of online/ offline education		Problems Solved by Each Mode			
		O+O	O2O	OMO Dual Teacher Class	OMO IAE
Offline	Constraints on time and space	✓			✓
	Capital intensive, high marginal cost			✓	✓
	Small institutions lack systematic content development			✓	✓
	Small institutions lack brand construction			✓	✓
Online	Poor learning experience	✓		✓	✓
	High customer acquisition cost	✓	✓	✓	✓
	Customer's willingness to renew is low	✓		✓	✓
Common	Teacher resources is the bottleneck			✓	✓
	Insufficient customization of class and high cost of 1-on-1 teaching				✓

Sources: Deck research, Interviews, EY-Parthenon analysis

The development history of OMO education coincides with that of the retail industry, both of which follow the path of “Offline - Online - O+O - O2O - OMO”. While OMO is still new to education with related products and business models in the early stage,

it has generated a mature business model in the retail industry with tremendous market potential. With the development of AI technology, AI Adaptive Learning will play a more critical role in OMO education and bring greater value to our society.



Sources: Deck research, Interviews, EY-Parthenon analysis

2.2 Business Models for OMO AI Adaptive Learning

		To B Mode		To C Mode
		Franchise	Authorization	Direct-sale
Revenue Streams		<ul style="list-style-type: none"> ▶ Franchise fee ▶ System usage fee 	<ul style="list-style-type: none"> ▶ System usage fee 	<ul style="list-style-type: none"> ▶ Tuition fee
Brand exposure		<ul style="list-style-type: none"> ▶ AI adaptive companies 	<ul style="list-style-type: none"> ▶ Education institutions 	<ul style="list-style-type: none"> ▶ AI adaptive companies
Operation Service	Campus construction	●	●	●
	Course input	●	●	●
	Teacher recruitment	○	○	●
	Student recruitment	●	○	●
	Operation training	●	●	●
Strategic direction		<ul style="list-style-type: none"> ▶ Rapid market expansion ▶ Brand image building ▶ Controllable cost to realize profit 	<ul style="list-style-type: none"> ▶ Rapid market expansion ▶ Controllable cost to realize profit 	<ul style="list-style-type: none"> ▶ Brand building ▶ Profit realization



Sources: Deck research, Interviews, EY-Parthenon analysis



Under the wave of OMO education, AI Adaptive Learning products, have been widely recognized by the market in the recent years with their own competitive advantages. Players have figured out various business models during the process of market expansion and penetration.

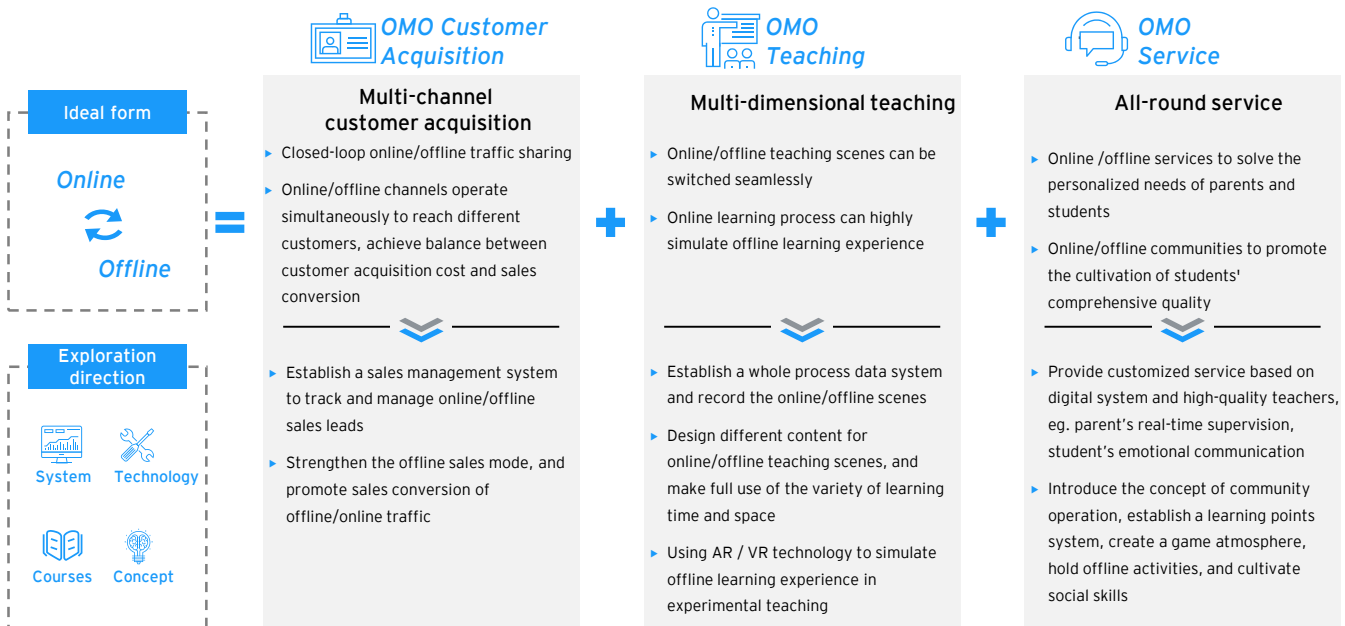
There are currently three types of business models in the OMO AI Adaptive Learning industry: franchise, authorization, and direct sale. Each differs in various dimensions including revenue stream, brand exposure and operation support, which are suitable for companies with different strategic directions:

- ▶ **Franchise:** AI Adaptive Learning players charge a one-time franchise fee to institutions for the complete use of brand name and promotion support. They will also be deeply involved afterward in franchisee's site selection, curriculum development and operation training, but offer limited support to the teacher and student recruitment. Meanwhile, the franchisor will collect system usage fee from the institutions (charge modes include monthly account usage fees, commission on tuition, etc.), and provide complete after-sales system support.
- ▶ **Authorization:** AI Adaptive Learning players are relatively less involved in institutions' operation process, who simply sell the right to use system and charge corresponding usage fees. The authorized institution retains its own brand name for independent operation and relies entirely on its own resources to recruit teachers and students.
- ▶ **Direct sale:** AI Adaptive Learning players have direct access to consumers and earn 100% of the tuition fee as their own revenue. Meanwhile, they need to undertake all the operation work and be responsible for profit and loss, which is a more capital-intensive mode compared with the other two.

Generally speaking, To-B models such as franchise and authorization are more prevalent among current players, which allow them to expand rapidly with low cost in the early stage and optimize algorithm with the accumulation of large-scale user data, creating a double barrier in both business scale and product development. Compared with authorization, the franchise is more favorable for AI Adaptive Learning players by further establishing its To-C brand image and strengthening customer loyalty in the long run. Meanwhile, it also offers more operation support for institutions. Industry analysis shows that Squirrel Ai, a franchise mode adopter, has partnered with more than 2,000 institutions nationwide in just five years since its foundation, and earned good reputation among parents and students. A series of successful cases indicates that To-B business model has been well proven by the market.

On the other hand, only a small proportion of players adopts the To-C direct sale model in AI Adaptive Learning industry, most of which are experimental projects launched by traditional institutions such as Jinghan Education to test the new business model and products, or demonstration schools opened by To-B players as a pilot for To-C business. The main reason is that To-C model is capital-intensive, and it is tough to rapidly expand relying only on its resource. However, it is undeniable that direct-sales model is beneficial to companies who aim to take complete control over operation and user data, and further expand their revenue. As OMO matures in the education industry, players will switch from blind expansion to high-quality growth, promoting the adoption of direct-sales model. It is worth noting that industry-leading players, such as Squirrel Ai, are trying to integrate direct-sales with the franchise to make full use of each model's advantages at different development stages to break through the barriers of OMO.

2.3 Exploration Direction of China's OMO AI Adaptive Learning



Sources: Deck research, Interviews, EY-Parthenon analysis



The application of OMO in AI Adaptive Learning is still at the exploration stage. Looking ahead, there's still a lot of room for further improvement in business operation, to effectively integrate AI Adaptive Learning with OMO, and provide parents and students with superior customer experience across multiple scenarios.

According to EY-Parthenon, the ideal form of OMO AI Adaptive Learning will fully achieve online/offline integration in 3 dimensions: customer acquisition, teaching and service.

- ▶ **OMO Customer Acquisition:** A two-way integrated customer acquisition channel shall be established between online and offline, which on the one hand, could form a closed loop to share leads and boost sales, and on the other hand, could precisely reach different target segments in the most efficient way. As the customer acquisition cost keeps soaring, AI Adaptive Learning players can make full use of their multi-channel franchisee network, establish integrated sales systems to achieve unified management of sales leads. Moreover, the offline trial class shall be strengthened to enhance the sales conversion between online and offline.
- ▶ **OMO Teaching:** An integrated teaching mode shall be designed, with seamless switch and smooth user experience between online/offline scenarios, raising higher request for AI Adaptive Learning players on their product design and service delivery. Companies need to fully integrate online/offline data, and design tailored learning content based on diversified online/offline scenarios to fulfill various user needs. Meanwhile, players can also introduce innovative technology such as AR/VR in experiment courses to minimize the difference between online and offline.

- ▶ **OMO Service:** A full range of integrated customer services shall be provided across online/offline to meet the customized needs of students and enhance their comprehensive capability. It can be foreseen that an integrated online/offline network, with the digital platform and professional faculty, will be crucial for players to develop their service system. In addition, players can introduce community operation, set up learning credits systems, and create a game-based learning atmosphere to enhance students' learning initiative. Regular offline activities could also be organized to further foster students' comprehensive abilities such as social skills.

In conclusion, the ideal form of OMO AI Adaptive Learning shall focus on the multi-channel customer acquisition, multi-dimensional teaching mode, and all-round customized service through deep integration between online and offline.

03

China's AI Adaptive Learning Market Outlook



3.1 Development trends of China's AI Adaptive Learning Industry

01

More traditional entrants

More traditional institutions transfer to intelligent adaptive education

02

More subject coverage

Greater coverage from science to arts and language courses

03

More education stage coverage

Extension towards other age groups of students

04

More approach oriented

From exam-oriented training to quality cultivation

Sources: Deck research, Interviews, EY-Parthenon analysis

Currently, the AI Adaptive Learning market is still at the early stage in China. EY- Parthenon outlines four development trends of the AI Adaptive Learning industry.

- ▶ **More traditional entrants:** It can be expected that more traditional education institutions transform into the AI Adaptive Learning area in the future. As we can see globally, several education publishers in the United States have developed their own AI adaptive learning platforms through acquisition or cooperation with intelligent technology/service providers (i.e., ALEKS and Knewton). In addition, MOOC companies, like Coursera and Khan Academy, have also begun to develop AI adaptive courses that can be dynamically adjusted to fit each student's capability. In this case, we think this trend will also occur in China with higher acceptance to the concept. The transform of traditional players will definitely higher the penetration rate of AI adaptive solutions in China.
- ▶ **More subject coverage:** Currently, mathematics and sciences are typical applications for AI Adaptive Learning because their logical knowledge points are more easily structured. In the future, with the development of algorithms and deeper understanding to the knowledge graph of liberal arts subjects, AI Adaptive Learning will be applied to these new subjects to meet the growing demand from K-12 age groups and their parents considering the importance of liberal arts in education.
- ▶ **More education stage coverage:** AI Adaptive Learning companies are almost all targeted at the K-12 market now in China. However, we believe the AI Adaptive Learning also has great application value and development prospects in the higher and professional education market. It can be foreseen that with the increasing penetration of AI Adaptive Learning products into the traditional education market, more players will begin to enter the higher and professional segment.
- ▶ **More approach-oriented:** The traditional K-12 education in China is exam-oriented, but the importance of approach-oriented education has begun to show up as the new generation of parents put more emphasis on children's all-round development. We can expect that the capability of AI Adaptive Learning will not be limited to specific knowledge tutoring but also quality training. It's worth noting that the cultivation of students' comprehensive quality does not stay on STEM teaching or similar, but goes further into the cultivation of students' thinking, learning ability and learning approaches. Domestic players such as Squirrel Ai has been starting to explore these areas, using the MCM system to organize and split ideas, methods, abilities into the teaching process of AI Adaptive Learning in order to realize the full cultivation of student's learning habits and comprehensive quality in a quantifiable and practical way.

3.2 Future of China's AI Adaptive Learning Industry

China's AI Adaptive Learning will usher in all-round development in the next few years. In the near future, this market will have more and more players with different kinds of backgrounds. We should realize that this market cannot have a steady growth without the cooperation between market players and social communities. A healthy market ecosystem should be built upon proper regulation, standards and talent development.

3.2.1 Movements from market players

With the recent development of the China AI Adaptive Learning market, the competition landscape is also changing quickly with more companies entering the market from different angles. In the short-term, EY-Parthenon predicts that the landscape will be relatively stable with the following major types of players. They are going to play with their own strengths while looking for innovation to take the lead.

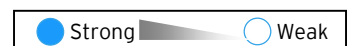
- ▶ **Existing Players:** current leading education players such as Squirrel Ai have become pioneers in this market by launching developed AI adaptive products. With over five years of business operation, these players have accumulated sufficient experience in curriculum contents, user data, AI algorithm etc., and establish an industry-wide reputation. In the future, these existing players will continue to expand their competitive advantage from two angles: 1) Increase their brand image by providing better product and service to users; 2) Enhance their cooperation with local education bureaus and schools to seize all opportunity from the offline education institutions.
- ▶ **Emerging Players:**
 - ▶ **Traditional education group:** TAL, New Oriental and other traditional education giants have been exploring AI Adaptive Learning application in recent years. This kind of transformation won't be easy for them, but they could keep their competitiveness if they could fully leverage their advantages in offline resources, student data, local relationships, cooperation with technology companies or AI start-ups.

► **Online education platform:** The Covid-19 has brought unprecedented developmental opportunities for online education platforms. The increasing demand also drives them to develop self-owned AI-assisted tool. They have a strong base of user volume but lack critical resources as original curriculum content, user data and offline operation capability. If these players want to capture more share of the AI Adaptive Learning market, they need to make up for the shortcomings of capabilities quickly.

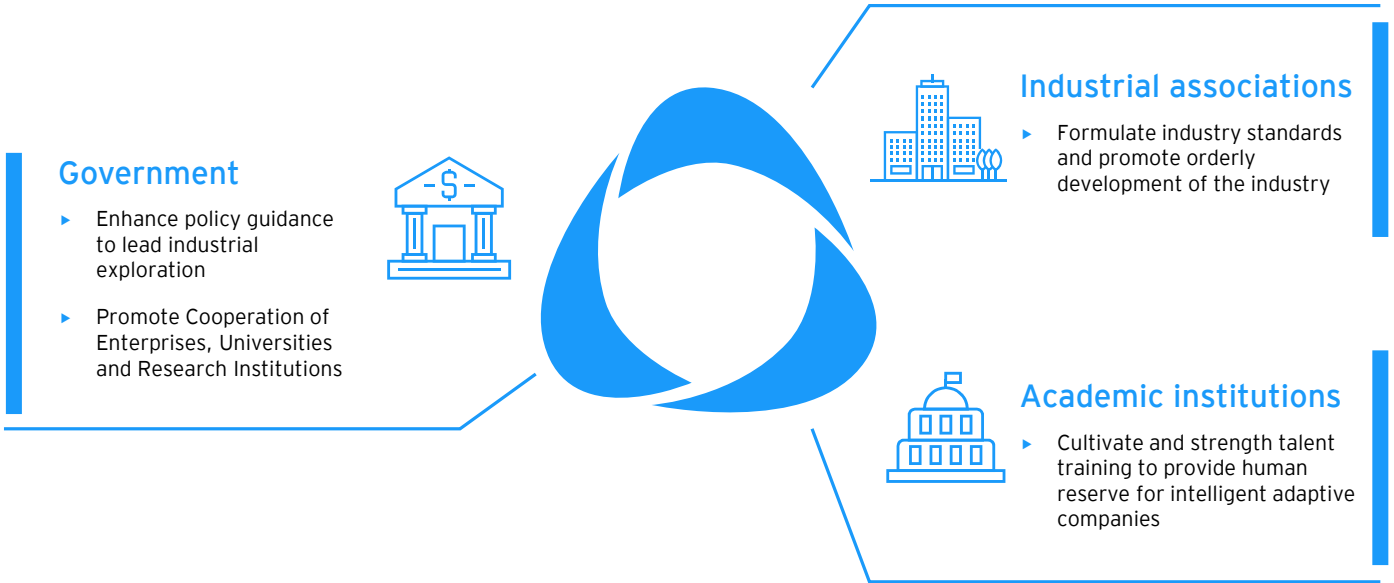
► **Technology companies:** Considering AI Adaptive Learning is a cross-field between AI and education, many tech companies such as ByteDance, iFLYTEK are attracted to enter recently. ByteDance first entered the education sector through investment in 2017, then launched aiKid (an English teaching platform for K-4 children in 2018 to try AI live stream education. Its most recent product is called “Guagualong”, which is an English enlightenment course to kids. Tech giants have robust AI technology to iterate its AI adaptive learning products in recent 3-4 years to build up its market competitiveness quickly. However, their future success may still rely on the quality of course content, user data accumulation and offline operation experience. Technology companies may have to enhance these capabilities through organic growth or partnership/acquisition from external.

		Content development	Data accumulation	AI Technology	Suggestion
Current players					<ul style="list-style-type: none"> Leveraging on first-mover advantages, further polish products' quality and improve user experience Strengthen the cooperation with local education bureau and schools, explore the application mode of public school, and seize the opportunity in to-B penetration
Emerging players	Traditional education companies				<ul style="list-style-type: none"> Make use of the excellent teacher resources to adapt and internalize the content and experience of teaching and research to the intelligent adaptive platform Partner with tech companies to quickly accumulate AI technology and platform construction reserves
	Online education platform				<ul style="list-style-type: none"> Online/offline products sales transformation Take in the operation experience of offline institutions and build competitiveness in offline business operation
	Technology companies				<ul style="list-style-type: none"> Through internal reserves, or M&A externally to alleviate its shortcomings in content R & D and data accumulation Participate in offline business operation for more experience, rather than developing simple apps

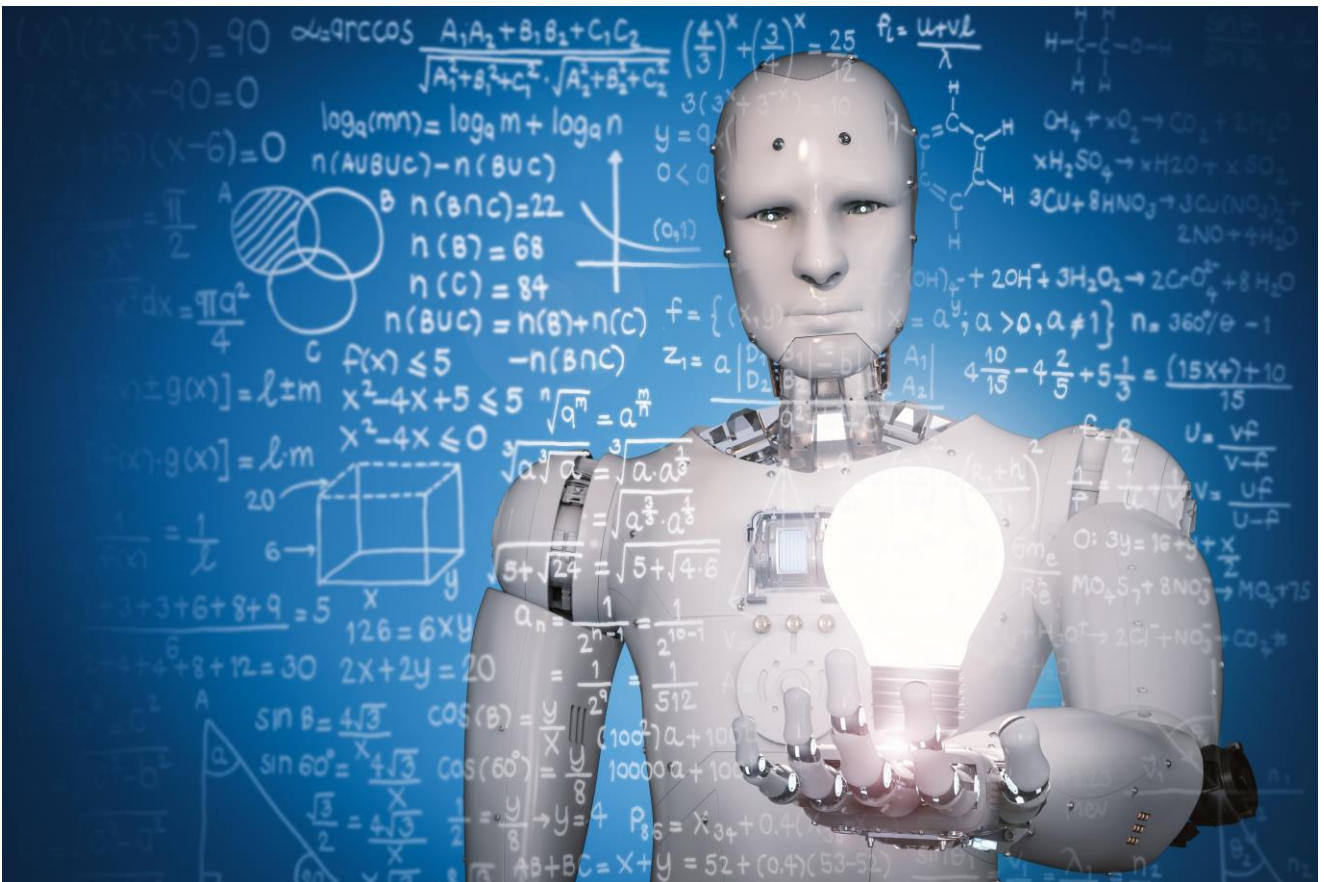
Sources: Deck research, Interviews, EY-Parthenon analysis



3.2.2 Support from social communities



Sources: Deck research, Interviews, EY-Parthenon analysis



The sustainable development of AI Adaptive Learning industry is inseparable from the cooperation from all sectors of society, especially from government, industrial associations, academic institutions and other authoritative organizations. EY-Parthenon would suggest the following preliminary initiatives to support the market development:

▶ **Government:**

- ▶ **Enhance Policy guidance:** China has been encouraging informatization and intelligent transformation in the education sector since the “New Generation of Artificial Intelligence Development Plan” was issued by the State Council in 2017 to clarify the importance of AI in education. In 2018, “Education Informatization 2.0 Action Plan” was released to prompt intelligence education. However, there was no further elaboration on the importance and related planning of AI Adaptive Learning in these documents, except for the “Shanghai Education Informatization 2.0 Action Plan (2018-2022)” to clarify AI Adaptive Learning be the future direction to explore. It would be even better if certain planning documents can be issued to make an official definition to “AI Adaptive Learning” and define actionable rules to support its application in education institutions and schools. Endorsement from government for the development of AI Adaptive Learning would be highly appreciated from all market players.

- ▶ **Promote Cooperation among commercial and academic participants:** Looking abroad, the application and development of AI Adaptive Learning products is closely linked with state-of-art research from colleges. Several market leaders are working with academic participants to set up AI Adaptive Learning labs to iterate competitive solutions. For example, Cognitive tutor is developed by Carnegie Mellon University, and ALEKS is jointly developed by the University of California and New York University. It can be proven that the collaborative innovation between commercial and academic participants could be the best way to develop AI adaptive solutions. However, this phenomenon looks rare in China mainly because of the research capability from academic institutions is still at the early stage. In this case, we would suggest government take the lead to set up collaboration platforms with corresponding funding to trigger the cooperation and help the market catch up with global faster.

▶ **Industry Associations:**

- ▶ **Set up industry standards:** With AI becoming the “hot word” in the education sector, more and more companies are now labelling their products with "AI", "adaptive education" and "AI Adaptive Learning". Some of the products cannot meet the standard of “AI Adaptive Learning” since AI cannot take charge of “teaching”. End users are not able to identify what is genuine as the backend technology is like a “black box” to the public. In order to make this market grow in a healthy way and provide customer-qualified products, a series of industry standards will be necessary to set up a clear rule for the products like what SAE did in autonomous driving. Looking back to AI Adaptive Learning industry, only a few leading players have put forward relevant standards. For example, leading companies abroad, such as Knewton and ALEKS, have carried out a learning effect experiment to measure the quality of AI adaptive teaching with the indicators like pass-rate, dropout rate, class completion time, etc. Chinese companies such as Squirrel Ai are trying to set up standards with indicators of score-raising rate, learning efficiency to evaluate the effect through mock comparison between AI and human. Nevertheless, the gap is still huge between the international and domestic industry standards and certification system. We believe that the AI Adaptive Learning industry can learn from the relevant measures in the field of autonomous driving to set up industry standards with the help of industrial associations, industry talents, and authorized institutions, which could benefit the healthy development of China AI Adaptive Learning industry.

▶ **Academic Institutions:**

- ▶ **Strengthen Cultivation of Talents:** It is no doubt that the demand for talents in all aspects of AI Adaptive Learning industry will boost in the next few years. However, according to the report “Talent Development of Artificial Intelligence Industry (2019 - 2020)”, issued by the Talent Exchange Center of the Ministry of Industry and Information Technology, there will be a 300k shortage of China’s AI talent, which has become a bottleneck of the industry development. On the other hand, AI Adaptive Learning is a disruptive innovation with a totally different teaching mode compared to the traditional one. We would suggest universities start to focus on cultivating compound talents with both AI and education background, who could fulfill the future needs of China’s AI adaptive learning players.

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Over the years, companies have paid efforts in advertising and promoting AI Adaptive Learning, but it still can not be recognized by the public, because its standards and criteria are kind of unclear. There are hundreds of relevant papers published each year and each defines various standards. Therefore, it is necessary to develop industry-wide standards. This is not something that a single company can do. It should be accomplished through multi-party cooperation between companies, industry associations, academia and the government. Currently, AIS (Adaptive Instruction System), a team under IEEE, is working on this.

-- Richard Tong, chair of IEEE Learning Technology Standards Committee & vice-chair of AI Standards Committee





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