

# How to Achieve a Balance between Teacher-Lead and Student-Independent Inquiry in A Digital Class? - A Case Study Based on Chinese Middle School Mathematics Teaching

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*Abstract: How to integrate digital information technology into classroom is not only a challenge, but also a test for both teaching and learning. Getting involvement of digital information technology into classroom extends students' learning in time and space, and alters teachers' teaching status. However, how can we achieve a balance between teacher-led and student-independent inquiry in a digital classroom? I hereby used "Reviewing the Image and Nature of Quadratic Function" as an example, compared and recorded the behavioral performance and results of teachers and students in an experimental comparison, and found that both teachers' leading and students' independent inquiring were indispensable, and a balance between them was a must-be goal if a maximal teaching effectiveness was expected.*

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## Background and Problems

WITH the deepening of classroom teaching reform in China and the continuous improvement of private education, the digital classroom model has been extensively studied, the traditional classroom has been quietly subverted, the subjective position of students has been becoming more prominent, and teachers' leading role seemed to be gradually weakened (Chen, 2018). Has the teacher's dominant position in the digital class been shaken? How should teachers position themselves in a digital class? How to plan and organize digital class teaching? In order to answer these questions, the relationship between teachers' instructing and students' learning should be re-explored.

The innovation of teaching conception should be at the forefront of the digital class teaching reform. Teaching conception indicates teacher's basic point of view that formed during the teaching practice, and the relatively stable thoughts and concepts formed based on this (He & Tian, 2015). Theory in general stems from practice, so as to the renewal of teachers' teaching conception that also comes from continuous reflection in the teaching practice. Digital classroom practice and exploration can help teachers to recognize them from the real world and to change their attitude towards teaching activities (Ding, 2018).

Our school stands at the front edge of education reform, and leads the exploration of digital classroom in practice. We collected rich experience in practice and put forward the theory of Student-Based Wisdom Classroom. The middle-school Mathematics team of our school carried out a seminar on the theme of "How to Realize the Balance between Teacher-led and Students' Independent Inquiry in Digital Classroom" using the course of "Review of the Image and Nature of Quadratic Functions" as an example. We explored following problems: How to fully demonstrate the leading position of teachers in a digital class while ensuring the subjective position of students? How should teachers use information technology to collect and provide feedback to students' problems? How should teachers use information technology to solve students' problems in a timely and appropriate manner?

The latest revision of Mathematics Curriculum Standards mentioned that the contents of mathematics should reflect students' real situations, conducive to students' experience and understanding, and thinking and exploration. Teachers should motivate students' enthusiasm for learning, stimulate their mathematical thinking, and encourage their creative thinking. Students' learning should be a lively, active and individualized process (Robinson, 2018). For mathematics learning, students are the masters, and teachers are the organizers, guiders and collaborators. "How students learn" largely depends on "how the teacher instructs". Our study on the basis of "Review of the Image and Nature of Quadratic Functions" was exactly the practical case for exploring the relationship between teacher leading and student independent learning in digital class, which possesses practical implementations for digital classroom teaching.

## **Research Plan and Proposal**

### **Research Design**

This study was conducted in all students in two parallel 8th-grade classes. The participants in both classes were 48 each. No significant difference in the cognition level and learning ability between the two classes. Teachers had a harmonious relation with students. This study was designed to follow the steps below:

1. Select topic.
2. Learning survey.
3. Identify research questions.
4. Classroom teaching discussions.
5. Focus on classroom practice.
6. Record teaching behavior.
7. Feedback and improvement.
8. Collection and analysis, induction and reflection.

### **Research Topic**

The quadratic function is one of the crucial functions of the middle school mathematics. It has its unique properties by combining quadratic equation to function. Changing the unary quadratic equation  $ax^2+bx+c=0$  to the quadratic function  $y=ax^2+bx+c$ , first,  $y=ax^2+bx+c$ , from the perspective of numbers, no matter what value being taken for the independent variable  $x$ , there is unique corresponding  $y$  to each  $x$ , so realized a transition from finite to infinite. From the perspective of shape, countless pairs of coordinate points  $(x, y)$  form a parabola. The concaving direction, symmetric axis, vertex, maximum or minimum value, and increasing and decreasing properties, all these are the key and difficult points for students to overcome.

### **Learning Situation Analysis**

From the eighth-grade, students begin to contact the concept of function. On the one hand, they were constrained by the intuitive thinking of the elementary education. On the other hand, the abstract thinking has not yet developed. So they expressed fear and even resistance to the problems related to the function. They do not know what function is, and what the function can be used for, and so how they know to learn function. Therefore, no matter from the preparation of knowledge, psychology, and ability, they do not know the direction and methods of how to learn function effectively.

### **Research Steps**

Base on the analysis of student's learning situation, and to carry out the study effectively, the following steps were determined:

1. Collect learning problems, such as the error-prone points and the causes for quadratic function learning;
2. Research and discuss the classroom teaching, determine the teaching objectives and difficult points, and design classroom teaching session;
3. One topic, several repeats. In brief, a teacher from the group first have a “diagnostic teaching” according to the contents, with the other group members as the listeners, and then collect consultation and feedback after the class and propose amendments for improvement, and then repeat the teaching.
4. Form model lesson as the reference for others.
5. Imitate the model teaching, promote development of the same course type, and implement mutual-assistant observation. The steps are: i) Team members agree on the theme and key points of classroom observation before instruction, and assign job task. ii) The observer needs to observe carefully and records the real situation with comments. iii) After class, a thorough discussion is organized by focusing on themes and key points. Recording teaching video is recommended. Iv) *Post hoc* adjustment and implement the improved measures in the follow-up teaching activities.

## **Focuses of Class Observation**

1. How does the teacher use digital technology to motivate students’ interest in learning?
2. How does the teacher know students’ learning efficacy before and during the class?
3. How does the teacher lead the digital class and help those who are in need to internalize knowledge?
4. Through in-class test to see if students have mastered the key points they learned.

## **Implementation**

### **First-round Teaching Scene**

*Teacher:* Does any student remember the concept, image and nature of quadratic function? Ok, now, let’s take a chance to review the knowledge map of the quadratic function presented by the group one. Please listen carefully and add missing points at any time.

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*Teacher:* Do you have any questions about the knowledge map of the quadratic function? What else do you need to add?

*Students:* No.

*Teacher:* Ok, please complete the time-limited tracking questions focusing on each knowledge point in the tablet. (The teacher sent the questions out to students’ tablets)

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*Teacher:* Time is up, now let's check the uploaded results, and ask one of you to tell the reason why you did like that.

*Student:* Because the general form of the quadratic function is  $y=ax^2+bx+c$ , and given it passes through three points: (-1, 0), (3, 0), and (0, -3); so we can plug these three points in  $y=ax^2+bx+c$ , and get  $a=1$ ,  $b=-2$ , and  $c=-3$ .

*Teacher:* So, what's your answer finally?

*Student:* Ooh, yes. The function should be  $y=x^2-2x-3$ .

*Teacher:* Thank you.

*Teacher:* Ok, now, please look at the next question, draw the curve line of the quadratic function  $y=x^2-2x-3$ , write out its concaving direction, axis of symmetry, vertex coordinate, and increasing and decreasing properties. (Teacher is walking around)

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*Teacher:* Time is up. Let's have a student to show his work.

*Student:* The curve line of  $y=x^2-2x-3$  is a parabola with concaving up, the axis of symmetry is  $x=1$ , the vertex coordinate are (1, -4), and it is increasing when  $x<1$  and decreasing when  $x>1$ .

*Teacher:* According to your drawing, what conclusion can you get?

*Student:* The intersection of the parabola with the y axis is point (0, -3), and with the x axis are points (-1, 0) and (3, 0).

*Teacher:* Ok, good. In general, how can you determine the intersections of the parabola with both the x and y axes?

*Student:* Set  $x=0$ , then find y, we can get the intersection with the y axis. If set  $y=0$ , then find x, we can get the intersection with the x axis.

*Teacher:* Right, does anyone have anything to add?

*Student:* The intersections of the parabola with both x and y axes are exactly the three-point coordinates that were already given in the question stem. So we don't have to draw a curve line.

*Teacher:* Yes, but do you need to draw the curve line for getting the axis of symmetry and vertex coordinate?

*Student:* No, we can get them by calculation.

*Teacher:* So, now, what's role does the quadratic curve line have in helping us understand its nature?

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## **Classroom Feedback and Problems**

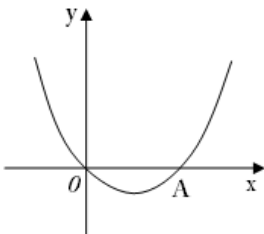
After the lecture, we conducted a classroom test survey of the 48 students in the first class. The feedback was as follows (**Table 1**).

Problems:

*1. Students' self-organization of the knowledge map was not deep enough.*

Prior the lecture, students' self-review of the basic knowledge of the quadratic function had little effect. During the lecture, they could not do further internalization of the knowledge independently, and the review efficiency was low.

**Table 1. In-Class Test Feedback.**

Test Contents	Correct Answer #	Correct Percentage
As the coordinate curve shown, parabola $y=x^2+bx+c$ passes the original point and intersect with x-axis at point A (2, 0).		
		
Q1. Find the quadratic equation.	42	87.5%
Q2. Find the coordinates of the intersections, axis of symmetry, vertex, and increasing and decreasing properties.	36	75%

*2. Students still did not understand the association between quadratic function images and properties.*

Although students remembered the concept of the quadratic function clearly, it was not that thorough. Their understanding of the quadratic curve stayed only at the beginner's level as it was a parabola; especially the features of the quadratic curve were not formed deeply in mind. Although they knew the method how to find the intersections of the parabola with the coordinate axes, they could not judge the position of a point whether it is the intersection of the parabola, which indicated that they did not combine both numbers with the curve when they were reviewing of the curve and nature of the quadratic function.

*3. Students were lacking of eager for active learning and mathematical thinking.*

When reviewing the quadratic knowledge map or the connection between its curve and nature, students mostly were led by the teacher, and there was no desire to actively explore. The independent status of students was not obvious, but teacher's leading position was too prominent.

*4. The function of the tablet has not been used totally.*

First, teachers only used tablet to send questions to students and checked their answers, of which belongs the basic function of physical projector. Second, teachers did not take advantage of the beneficial function of tablet to help students understand the abstract knowledge in a concrete way. This was another reason for the low efficiency of classroom review.

## Discussion for Teaching Improvement

After finding the reason for the class failure, the team members conducted an in-depth research and discussed the following issues to strive to apply what they found to the digital classroom.

### ***What Aspects of the Digital Classroom Should Teachers Lead?***

In the digital class, students' learning was no longer limited only in the lecture, but also including prior, during, and post the lecture (Wu, 2018). Through tablet, students can learn anytime and anywhere, which means their learning pathway is increased. We need to catch up the progress of technology, and take a full advantage of the digital teaching. Students can learn by themselves, and what teachers can do is to help and guide them consume and digest what they cannot understand. By careful observation, we thought further raised questions as: i) Can digital technology help students to learn independently before lecture? ii) Can digital technology improve students' learning efficiency in the class? iii) Under what circumstances do they need teachers' help? iv) How can we show them the valuable teaching resources? After discussion, we reached the following consensus:

- (1) Self-learning before the lecture needs teacher's guidance. For example, prior to the lecture, teachers can guide students to display the basic shape and nature of quadratic function at the back scene.
- (2) The classroom interaction needs feedback timely and teacher's guidance if appropriate. For example, students can submit answers to the system, and the system will automatically collect and provide with statistical graph of their responses to teachers for better decision-making.
- (3) Some individual problems need teachers' individualized help. For example, during the lecture, if found some students were unable to submit answers in time, and then teachers could give them appreciate help.
- (4) Class content extension needs teachers' expansion. In the digital class, teachers can supplement extra teaching resources anytime to improve the efficiency of class learning.

### ***How Should Teachers Lead the Student-independent Digital Class?***

First, teachers publish a self-learning list of tasks on the tablet to guide students to learn independently before lecture. The self-learning list of tasks was designed by the teacher following the study guide (topics, objectives, preview navigation, classroom display), learning tasks (through watching the micro-courses, textbooks or other resources). Each specific task should reflect each key point that was presented in corresponding questions, including necessary resource information like super links.

Second, teachers create a classroom interaction environment with equal communication. Teachers create a learning atmosphere that is both easily controlled and relaxed, of which includes such as personal response, group discussion, group presentation, and group competition, etc., helping students internalize what they have learnt. In

the digital class, by sending learning resources on the tablet, a positive learning environment was established to promote students' self-exploration and induction. For instance, in the dynamic demonstration of quadratic function, teachers can know students' understanding of the function via instructing them on the symmetry of the parabola and its increasing and decreasing properties, and give them guidance, correction, and interpretation in time.

Third, teachers should pay their attention to each student, especially to those under the average. Given each student's ability is either high or low, and also different in the basis of knowledge. Oftentimes, incorrect learning habits are the major reason for those under the average. For these students, teachers should assign hierarchical learning tasks prior to the lecture and tell them the key points in advance. For example, in preparing the autonomous learning task of the quadratic function, teachers can design questions based on the conception, coefficient determination method, vertex and axis of symmetry, etc.

For students who are really difficult to participate in the self-exploration of classroom interaction, teachers should give them guidance in time, and send micro-courses or photo resources to the tablet, such as teachers' lecture video, clear problem-solving steps, and concise notes, etc., and let them watch repeatedly to catch the points.

### ***In The Digital Class, How Can Teachers Effectively Solve the Common Problems of Students?***

In order to effectively solve the common problems of students, teachers should be intelligent enough to organize class interaction and good at guiding problem solving. The micro-course teaching method believes that internalization and expansion are the keys to digital class (Liu, 2014). Therefore, when reviewing the quadratic function, teachers can design questions with different levels to help students internalize and expand its curve shape and nature. In the basic part, the application of basic knowledge and basic skills are the key requirements. In the part of comprehensive application, the internal connections among various knowledge points are the essence. In the part of ability improvement, the logics, flexibility and innovation of thinking are the main points.

## **Teaching Scene after Adjustment**

### ***1. Communication within the group.***

*Teacher:* Everyone, you reviewed The Shape and Nature of Quadratic Function last night. [Blackboard writing: *Reviewing the shape and nature of the quadratic function*] Now, let's first do a group communication, and then have a group report to see which group will be the better. Please take out your study sheets. I will give your 5 minutes to share the knowledge points you have reviewed in the groups. Are there any problems confusing? Be sure to record what you shared in the group.



## 2. Group presentation.

*Teacher:* Now it is group report time. Which group will be first? The other groups should listen carefully and be ready to add any time.

*Group 1:* After discussion, our group agreed that the best way to review the quadratic function is to draw the curve first, and then find the features belonging to the parabola, i.e., the intersections of the parabola with both x and y axes, the axis of symmetry, and the coordinate of the vertex. But we are still unclear with the increasing or decreasing characteristics.

*Teacher:* Good report. Now you know what you have already learned and what the difficulty is. Group 1 is confused about the increasing and decreasing characteristics. Which group can help them?

*Student 1:* We can explain it visually. For example, look at a parabola. If the opening is upward, on the left side of the axis of symmetry, the parabola goes down first, and then reaches to the lowest point; on the right side of the axis of symmetry, it goes up; so it looks like a canyon. On the contrary, if the opening is downward, on the left side of the axis of symmetry, the parabola goes up first, and then reaches the highest point; on the right side of the axis of symmetry, it goes down; so it looks like a mountain. In general, going up is increasing, and going down is decreasing.

*Student 2:* We can also explain that by observing the increasing or decreasing of a function, it should be viewed from left to right. [The student used the “Student Demo” function of the tablet to point from left to right with a stylus pen, and different colors appeared on the classroom screen]

*Teacher:* Pretty good understanding. Using examples and number-shape combination will help to understand the quadratic function easily. Do you have any other questions?

*Student 3:* What is the connection between quadratic functions and unary quadratic equations?

*Teacher:* Who knows about this?

*Student 4:* I know. From the textbook, if set the function value  $y = 0$ , the quadratic function becomes a quadratic equation.

*Student 5:* Can someone give an example?

*Student 6:* For example, the quadratic function  $y=x^2-2x-3$ , when  $y=0$ , it becomes  $0=x^2-2x-3$ , i.e.,  $x^2-2x-3=0$ . [*Sending the function image drawn by the geometry board in the tablet, mark the point when  $y=0$ .*]

*Student 3:* Is this the connection between the quadratic function and the unary quadratic equation?

*Student 7:* Not exactly. The solution of the quadratic equation is the abscissa of the intersection of the quadratic function curve with the x-axis, and the ordinate of the intersection is 0. For example, the solution of  $x^2-2x-3=0$  is  $x_1=-1$ ,  $x_2=3$ , so the coordinates of the intersection of the quadratic function curve and the x-axis are  $(-1, 0)$ ,  $(3, 0)$ . [*Display the coordinates as the marker points.*]

*Student 5:* What if the quadratic equation has two equal solutions?

*Student 8:* Only one intersection point between the quadratic function curve and the x-axis.

*Student 5:* What if the unary quadratic equation has no solution?

*Student 9:* That means no intersections between the quadratic function image and the x-axis.

*Teacher:* Very good, your analyses are very clear, it is amazing. Do all of you understand it?

*Student 10:* I want to know if I can understand it in reverse.

*Student 7:* Of course, please see the curve [*The parabola curve on the tablet can be moved up and down*]. When I move the parabola and get two intersection points between the quadratic function and the x-axis, that means the quadratic equation has two unequal real number root, that is,  $\Delta > 0$ . If only one intersection point between the quadratic function curve and the x-axis, that means the quadratic equation has two equal real number root, namely  $\Delta = 0$ . If there is not intersection point between the quadratic function curve and the x-axis, that means the quadratic equation has no real number root, that is,  $\Delta < 0$ .

*Teacher:* Thank you for the wonderful explanation. You all are the best explainers.

*Teacher's Summary:* The idea of combining numbers and shapes is essential in the study of functions. It is not that difficult to understand the nature of the quadratic function, and it depends on whether you understand the curve shape or not, and whether you can raise your own questions and summarize the rule. Therefore, if you have the rule in your mind, the curve shape will appear, and it is no longer difficult to learn the quadratic function.

## Improved Teaching Compliance: Test and Analysis

After the lecture, we conducted a test survey of the 48 students in the second class who attended the lecture. The feedback is showed in the **Table 2**.

After continuous improvement of the classroom teaching, the teacher-led digital class has initially achieved the expected results. Undoubtedly, digital applications have indeed brought subversive changes to the classroom instructing (Sean, et al., 2019).

Our data indicated that an effective digital class must reach a balance between teacher-led and student-independent inquiry. From student's point of view, the teacher-designed self-learning list of tasks can guide students to predict the key points and difficulties of the class. Students are no longer afraid of group discussion, questioning and presentation in the class. From the perspective of psychology, teachers first let students have a sense of security for learning mathematics, and help them actively participate in the in-class internalization of knowledge. Establish a positive learning environment with teacher's leading, so that students are able to be managed easily and also provide with a relaxed and happy cooperation (Rojin, et al., 2018). In the interactive part of the lecture, students' thinking was quick and responsive, and they questioned and answered, and ordinary students also are willing to participate in. If questioning is the heart of mathematics, then student's thinking and debating are the blood of mathematics. At the

**Table 2. In-Class Test Feedback.**

Test Contents	Correct Answer #	Correct Percentage
If parabola $y=x^2+bx+c$ passes the original point, and intersects with x-axis at point A (2, 0).		
Q1. Find the quadratic equation.	48	100%
Q2. First evaluate the intersections of the parabola with axes, and then find the coordinates of the intersections, axis of symmetry, vertex, and increasing and decreasing properties.	44	91.6%
*Q3. (Challenge yourself). Draw a sketch curve of the parabola first, and then find the range of x to fulfill $x^2+bx+c>1$ .	26	54.1%

same time, with the diversified learning resources in the digital class, the internalization and expansion of knowledge is no longer monotonous, but intelligent and innovative.

From teacher's point of view, the improved teaching results are ideal. The reason for success can be attributed to the guidance of the self-learning list of tasks to students' learning and the support of digital resources in the class. Our mathematics team felt that the process of designing self learning task list is a process of giving full play to teacher's leadership. In this process, teacher needs to know what questions students should learn independently. What methods can be provided to make students' self-learning more effective? What activities are innovative in class design? How do these activities link to self-learning? Only when a teacher seriously thinks about these problems and then designs the teaching process and organizes the classroom teaching, he can truly stimulate students' learning potential and lead student-based intelligent class.

## Results and Conclusions

The advent of the digital technology has brought great influence on mathematics teaching. The traditional mode on the basis of textbooks between teacher and students can no longer meet the needs of current students (Zhang, 2017). We found that the future mathematics class needs to integrate with the information technology, and a balance between teacher-led and student-independent inquiry is necessary. Meanwhile, along with the confusion from teaching practice, we carried out this study based on digital class teaching. During the study, the renewal and innovation of teacher's instructing conception was inspired. During the discussion, we broke through the bottleneck of teaching thinking. With the help of information technology, we broke the limitations of time and space, explored the relationship between teaching and learning, and obtained useful results.

The aggregation of ideas and the collision of thoughts have the digital class teachers gotten more thoughts and refinements on their leading role. We had a further understanding on the teaching mode of the digital class, improved teachers' instructing skills and promoted students' independent ability, and realized development of both teachers and students.

## **The Teaching Mode of Digital Class Should Be Based on “Acquiring Knowledge before the Lecture, Internalization during the Lecture”**

From the perspective of the whole teaching process, the teaching mode in the digital class can be regarded as the thread of teacher's design of the self-learning list of tasks for students. Organizing classroom interaction allows students to freely think through the use of rich learning resources on the basis of independent learning. The student's subjective position was preserved and the teacher-led position continued. Through this, teachers' prior-class preparation is no longer the same, the lecture is no longer in one tone, and the in-class instructing will not fall into a boring constant process, so there may be more classroom teaching accidents, which means that students are really involved in the class activities under the guidance of their teachers. How to find a perfect match between the teaching presupposition and the class generation that can really arouse students' active inquiry is worth paying attention. From our case study, we found that the key to digital class is that teachers can achieve an effective “guidance” in the teaching presupposition, i.e., how to guide students to effectively learn new knowledge and achieve it in a more effective way. At the same time, teachers are required to have their own unique insights in the instructing materials, have a deep understanding of the key and difficult points, and have a sufficient and diverse preparation. Only in this way, teachers can give effective guidance on students' questions and thinking during the lecture.

### **Appropriate and In-Time “Guidance” to Inspire Students**

Through self-learning list of tasks, teachers can know students' understanding of knowledge and possible problems, including their learning styles and habits, thinking habits, learning obstacles and weak points, so that a targeted guidance can be processed on the points. How to “guide” is more conducive to the completion of the teaching purpose and more conducive to the development of their ability? In our case study, teachers solved students' problems via group communication and cooperation, focused on knowledge internalization and expansion, and then helped them form question series, from which the solutions to the problems could be more open. Therefore, when time is opened, students will have enough time to delve into their most doubtful questions; when the task is opened, it will meet students' needs at different levels, and lead them expand their learning breadth and depth; when the resources are opened, peer classmates will be the resources for cooperation and exchange, and the digital resources are really used; when the learning style is opened, some will like to think first, but some will like to discuss first; so students' abilities will be improved dramatically by doing, watching, and thinking (Major, et al., 2018). Especially during the class communication, students talked about the translocation of quadratic function curve to observe the number of intersections with the x-axis, which needs digital resources as the support.

## **Study Reflection**

The digital resources may be lagging behind. When teachers prepare lectures, they often know what resources are needed to solve students' questions, but many of them were collected resources based on solving the preset problems. When the teaching resources prepared before lecture cannot meet the classroom accidental generation, the teacher will not create resources in time, so the knowledge internalization can only rely on students' understanding and teacher's guidance.

Teachers' knowledge level of information technology limits the creation and use of digital resources. In recent years, information technology has supported the development of class teaching rapidly, but teachers were usually engaged in teaching work at school, and were not sensitive enough to information technology. We suggest that schools with good financial support can provide teachers with multimedia courseware production skills, micro-course recording, video and audio software use and other courses to enhance teachers' interest in information technology.

There is no contradiction between the subjective position of the student and the leading role of the teacher. Learning and teaching are two inseparable parts in the digital class, and they intertwined prior and post the lecture. In the front, students are working on the self-learning tasks through various resources, and internalizing and expanding group discussion, presentation, and exchanges. In the back, teachers are helping students complete their tasks, guiding and tutoring them to internalize and expand their knowledge during the lecture.■

## **References**

- Chen, H. (2018) Research on teaching interaction behavior under the flipping classroom mode. *Shenyang Norm Univ.*
- Cheska, R. (2018) Interactive and digital notebooks in the science classroom. *Sci Scope*, 41(7).
- Ding, Y.M. (2018) The application of "flipping classroom" in middle school mathematics teaching. *Gansu Edu*, 24:63.
- He, X.X., & Tian Z.D. (2015) The Chinesezation of Dewey's educational theory and its enlightenment. *Glob Edu Hope*, 44(1):34-48.
- Liu, R.P. (2014) Research on Dewey's interest education thought. *Hunan Norm Univ.*
- Major, L., Warwick, P., Rasmussen, I., Ludvigsen, S. Cook, V. (2018) Classroom dialogue and digital technologies: A scoping review. *Edu Inform Tech*, 23(5).

- Rojin, V., Kate, S. & Christy, W.P. (2018) Perceptions of digital tools and creativity in the classroom. *Int J Digit Lit Digit Compet (IJDLDC)*, 9(4):1-18.
- Sean, M.L., Charlotte, H. & Francis, W.F. (2019) The digital frontier: envisioning future technologies impact on the classroom. *Futures*.
- Wu, J. (2018) Research on middle school mathematics teaching based on the concept of flipping classroom. *Sci Consult (Edu Res)*, 9:58.
- Zhang, X.L. (2017) Application analysis of flipping classroom teaching mode in middle school mathematics teaching. *Curriculum Edu Res*, 50:121-122.

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## Appendix

### Self-Learning List of Tasks

#### Study Guidance

1. Project Name  
People's Education Edition Middle School Mathematics Review "Chapter 22 Quadratic Function"
2. Goal  
By watching the micro-video "quadratic function" mind map, the task of "autonomous learning task list" is completed to help students sort out the concept of quadratic function and its image and properties, and understand visually the connection between the quadratic function and the unary quadratic equation.
3. Learning method and recommendations  
Read the textbook P.55-P56 in the ninth grade volume I, understand the content of the review summary, review the questions based on the review and thinking session of the textbooks, watch the micro-video "quadratic function" mind map, and reach the goal of independent learning. If there is doubt, watch the video again and again.
4. Classroom learning form notice  
Self-study feedback - Assisting in inquiry - Consolidation and improvement - Induction summary - Lesson testing

#### Learning Contents

Complete the following tasks by watching the micro-course video:

1. What is the general form of the quadratic function? What form can I write? What is the connection between them? Please answer separately.
2. Please make an image of the quadratic function  $y=x^2-2x-3$ , and then generalize the nature of the quadratic function.
3. According to the image you made, please talk about the connection between the quadratic function and the unary quadratic equation.

#### Confusion and Advice

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