Evidence for Excellence in Education

FLIPPED LEARNING

HANDBOOK FOR SCHOOLS IMPLEMENTING FLIPPED LEARING USING KHAN ACADEMY

National Foundation for Educational Research (NFER) and Nesta

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PART 1

Summary

1.1 Purpose

This Handbook is for the person responsible for leading mathematics teaching in and/or the person who will be leading the introduction of Flipped Learning using the Khan Academy.

This guide covers in detail the use of the Khan Academy resources. For guidance on using other resources and the Flipped Learning approach in general please see our companion Flipped Learning Guidance for Practitioners.

1.2 Key points

This handbook contains:

- Introduction to Flipped Learning and The Khan Academy.
- Instructions for getting started with The Khan Academy and managing your classes.
- Models for possible use of the site in your teaching and learning cycle.
- Details of resources that map Khan Academy materials to The National Curriculum and Curriculum for Excellence.

PART 2

Introduction and overview

2.1 What is the purpose of this resource?

This resource is designed to support schools in implementing a 'flipped learning' approach to teaching mathematics using the Khan Academy online resources. The aim of such an approach is to relocate some of the time spent on initial instruction on topics to free up lesson time and enable the teacher to focus on: active learning; deepening the students' understanding; and developing students' skills as independent, responsible learners.

In addition, the Khan Academy website offers some powerful reporting functions which will allow teachers to:

- Explore gaps in students' understanding of key concepts: this affords the possibility of creating a baseline from which one can measure future improvement.
- Identify students who are struggling with a specific topic or concept: this identification, along with other data, can help teachers to select which approach might work best with different students – for example, peer tutoring with a proficient student or a one-to-one session or small group work with students who are struggling.
- Diagnose learning challenges: teachers will be provided with data on how students have used the Khan resources. They will know, for example, whether or not a student has viewed the video, and how many problems they have attempted. This information should help teachers to pinpoint conceptual misunderstandings and behavioural or confidence issues.

This guide is intended to guide you through the organisational and technical aspects of getting started with Khan Academy, and to provide some ideas for using it for best effect in your school. It provides detailed instructions to follow for some aspects, and more open-ended advice for others. The aim is to enable teachers to expend their effort and expertise on decisions related to pedagogy and learning.

This guide is based on research conducted by Nesta and NFER with nine schools in England and Scotland.

Every effort has been made to ensure that this guide, and the accompanying curriculum mapping documents, contain up to date links to online resources. However, as these often change, some of them may move in future.

If you need more support on using the site, try accessing the Khan Academy's coach resources at **www.khanacademy.org/coach-res/**.

If you are trying to use the mapping resources to access particular videos or exercises and have problems with the links, try copying the name of the resource you are looking for and pasting into the search bar at the top of the screen when you are logged in.

2.2 What is flipped learning?

Flipped learning is about using technology to maximise the time spent on active learning in school. Part of the learning process (usually direct instruction through video) is accessed online by students outside of the timetabled school day. This frees up classroom time for the teacher to focus on other more beneficial activities, such as working with students on topics they struggle with. For the purposes of this guide, we are using the following definition of flipped learning:

> *In flipped learning, delivery of content is undertaken via video instruction accessed online. Class time is focused on supporting students in working out the problems themselves. The activities undertaken in the classroom should, where available, be informed by online data (such as that collected through practice questions) which will show teachers what their students are doing and the pace they are moving at.*

From its original roots in video instruction, The Khan Academy has expanded to provide a range of problems and exercises for students to complete to practise and develop their learning of concepts. These exercises are delivered using an 'adaptive' approach, which responds to students' performance and alters the questions delivered based on their previous answers. The system also tracks the students' performance to provide information for teachers on how well they are doing.

2.3 What do we need to implement flipped learning?

For this approach, students will access the Khan Academy instruction videos and assessments outside of their mathematics lessons as part of homework. For this reason, students will need access to internet-enabled computers or devices (such as smartphones or tablets) outside of their mathematics lessons. While we think most students will have the necessary equipment at home, provision should be made for those students who do not have access to an internet-enabled device at home to be able to access an internet-enabled computer from within school, e.g. in the library during break times, lunch-time or after school.

PART 3

Getting started

3.1 Auditing student online access from home

We suggest that you audit the students you are using this approach with to find out whether they can access an online device from home. Arrangements might need to be made for some students to access an internet-enabled device from within school, e.g. in the library during break times, lunch-time or after school (see Section 2.3).

You are now ready to start looking at the Khan Academy website and supporting materials.

3.2 Familiarising yourself with the Khan Academy website

This approach uses the flipped learning resource on the Khan Academy website, which can be accessed from the following link: **www.khanacademy.org**

3.2.1 About Khan Academy

Founded in 2006, Khan Academy is one of the world's most popular education websites. It describes its mission as providing 'a free world-class education for anyone, everywhere'. As of February 2014, the site was receiving about ten million unique users per month. Khan Academy offers more than 5,500 instructional videos – of which approximately 3,500 are about mathematics. It also offers more than 100,000 practice mathematics problems that students can complete at their own pace.

Originally set up to help individual users learn on their own outside of formal schooling, the site has been developed into a resource that teachers can use as part of formal schooling, although at present the content is focused on teacher and student-users in the United States. We think the site has now reached a maturity which means it could offer genuine value to UK schools.

3.2.2 Creating a teacher account

To begin using the site you need to create an account. It is important that you set this up as a 'teacher account' so that you can manage the learning of your students on the site. To create your account, visit **www.khanacademy.org** and click 'Teachers start here'. You will then be guided step by step through the process of creating an account and the steps for setting up for your students.

3.2.3 Familiarising yourself with the site

When you first log into the site you will be presented with the options to view a tutorial, and then to take an assessment test as if you were a student. We highly recommend that you set some time aside to work through both of these steps, as they will familiarise you with the site from the perspective of a student in your class.

The initial test gathers information about your current knowledge and skill level, and presents a profile of what you need to learn next. If you do not know the answers to any questions you can choose 'I haven't learned this yet' and it will use this information to inform your profile.

Once you have completed a test, spend some time working through the first section the site recommends for you. The site uses data gathered from the work students have previously completed to recommend what they should work on next. As a teacher you have access to this data and can use it to analyse where students' learning needs lie. You can also recommend sections to your students based on the areas you are focusing on in class. Any recommendations you set as a teacher (or 'coach') will appear at the top of your students' lists when they log in.

3.2.4 Registering your class online

During the first session you will need to set aside some time for your class to register with the site and join a class group that you will set up.

Firstly, the students will need to set up their own account on the Khan Academy, then they add you as a 'coach'. Finally, you will need to set up a class and add the students to this class.

See the step-by-step instructions in the next section for how to manage this process.

For additional information, please see the instructions from the Khan Academy here:

www.khanacademy.org/coach-res/reference-for-coaches/how-to/a/get-your-class-online

3.2.5 Assigning homework materials

To get you started, we have mapped a number of the mathematics modules available on the Khan Academy website against the National Curriculum for England and Curriculum for Excellence for Scotland. These are provided in the accompanying curriculum mapping documents. While this will not stop you looking for your own Khan resources, the intention is that you will be able to focus your time on using, rather than searching for, appropriate teaching resources.

3.2.6 A note on the international content

You should be aware that the Khan Academy resources have been developed in the USA and therefore there are some international differences in the way key terms are presented. For example, on the website the decimal point is represented as '.' rather than '·' as it would be in Scottish and English schools. There are also some differences in language.

We have identified differences where possible in the curriculum mapping document so that you are aware of them. It may be useful to discuss these differences when they occur with your students. In some cases they may have the potential for a useful discussion of international differences in mathematics. In others you may feel they are too different and choose to avoid those particular aspects of the resources. In our trial some teachers used this as an opportunity for further discussion of international mathematics, others carefully avoided it to focus on the objectives in their curriculum.

3.2.7 Further resources

Khan Academy also provide a useful quick start guide for mathematics teachers:

http://bit.ly/khanacademyquickstart

3.3 Curriculum mapping

We have created two mapping documents to help with linking the Khan Academy themes to the curriculum. Once you have worked through this guide, these will likely be the main documents you use as a reference for your planning when using these resources.

The Khan Academy resources are organised into themes. Each theme contains a combination of videos for teaching new content, and exercises for learning through completing problems based on that content and consolidating through practice.

In order to make best use of the interactive exercises and the data that these excercises give learners and teachers, students may need to move through a theme as it is set out on the site. We have therefore set out these documents based on the themes, but indicating the curriculum links so that you can make links for your planning.

There are a number of potential approaches to planning using this mapping and The Khan Academy:

- **Khan Academy centered:** use the curriculum document as the basis of your planning. Choose a theme and plan homework and lessons to move through it, providing targeted support during lessons. Record the curriculum links from the document as your objectives on planning.
- **Khan Academy supporting:** use the curriculum mapping document to find specific resources such as exercises and videos that link to the objectives you have planned to cover using your normal planning workflows. This could involve replacing a teacher-led introduction with a Khan Academy video set as homework, or replacing text book exercises or problems with Khan Academy exercises.
- **A combination of the above:** use some themes direct from the site, and pick and choose resources at other points. Choose the approach based on the appropriateness of the resources to a particular area of the curriculum, and the experience and aptitude of your students in that area.

Our mapping documents linking the Khan Academy topics to curriculum areas are available in the spreadsheet files.

Problems accessing the resources

As this is a live website, future updates and improvements may break the links in our curriculum mapping. If a link is not working for you, the best approach is to copy the title of the resource you are trying to access and paste it into the search bar at the top of the screen when you are logged in to the site. Although there are updates from time to time, and new videos are uploaded, Khan Academy tend to keep lessons available so you should be able to access them in this way.

PART 4

Implementing flipped learning step-by-step

The following section contains step-by-step guidance, instructions and ideas for implementing flipped learning in your classes using 'The Khan Academy'. This is not a set of rules which must be followed, rather guidelines to help you get started.

4.1 Purpose

4.1.1 Keeping the purpose in mind

Before getting started it is important to keep in mind the purpose for you as a teacher in using this approach to learning. Some teachers aim to use the approach to motivate disengaged students, to develop independent learning strategies, or to broaden the repertoire of techniques they use as a teacher. For others, it may be to tailor the learning for every child using the analytics and data, or to move through learning at a different pace.

Different teachers will have different purposes, but it is important to the success of any project that every stage is planned with the purpose of the overall project in mind. This gives a greater chance of success than trying the resources out to give them a go without a clear aim in mind.

4.1.2 Recording your key aims and outcomes

Having reflected on your purpose and recorded your aims and objectives, set some key outcomes that you want to achieve from this project. Consider what it will look like if you have effectively managed to achieve your intended purpose. For example, if you are aiming to develop independent learning strategies, what will success look like? It could take the form of students arriving to lessons regularly having engaged in the set homework tasks. It could be that they are exploring ways they can find their way through problems and challenges, such as asking each other or undertaking independent research, resulting in fewer interruptions for you and more sustained interactions moving on the learning of individuals and groups.

New initiatives are much more likely to have an impact if you set specific aims and objectives and indicators for success and keep returning to these throughout.

4.1.3 Planning for aims, objectives and outcomes

Overall aim and key objectives for the project:

Specific outcomes :

Name	Outcome:	What success looks like:	What you will do to achieve success:
Example outcome	Students engaged in independent learning.	Students are using data and reports to identify areas of weakness. Reports show they are working on these areas and succeeding at the associated exercises.	Clearly communicate this aim to students. Communicate insights from reports to them, encourage them to complete exercises based on this. Monitor reports and discuss their use of the site highlighting the importance of taking responsibility for their own learning.
Outcome 1			
Outcome 2			

4.2 Introducing the Khan Academy website

As with any new approach or tool, expect to spend some time explaining the Khan Academy to students and familiarising them with it. Share with them the purpose of exploring this new approach and what you are hoping for them to get out of it.

Students will be much more likely to engage well and get the most out of flipped learning if they understand the purpose and objectives for the approach.

Give them an overview of the practicalities; when, where and how they will be accessing the resources, and the time commitment they will need to make, particularly for any homework you intend them to take part in. With this approach, homework becomes crucial, not just to their later success, but to their ability to participate fruitfully in the next lesson, and they need to understand your expectations for this.

Appreciate that it will take some time for both you and your students to get used to - this is expected. With most classes, it helps to share this with them, although this needs to be balanced with high expectations that they will engage with this new way of working and do their best to make it work.

4.3 Completing student sign-ups to the site

Instruct the students to go to www.khanacademy.org and use the ‘sign up by email’ option (note this is smaller than the other options).

Students fill in their name, email and date of birth.

A verification email is sent to them. They need to open their email and click on the link labelled ‘finish signing up’.

They then choose a username and password. Make sure that they make a note of these.

They are asked to complete a pre-test to check their skills. It is a good idea for them to complete this task whilst you make sure all students can log in. We recommend choosing the option ‘all the math’ and they will be tested across a wide range of mathematical content.

Once they have completed these steps, they need to join the class. On the left of the ‘Dashboard’, under ‘Community’, they need to click ‘Coaches’ and input the teacher’s email address and click ‘join class’. They are now set up on the site.

You may wish to copy and paste the following bullet points on a PowerPoint slide or handout to help keep students on track with the set-up process:

- Go to **www.khanacademy.org** and click '**sign up by email**'
- Fill in your name, email and date of birth (please use your school email)
- Go to your email, find the message from the Khan Academy
- Click on the link labelled '**finish signing up**'
- Choose a username and password. Make a note of these
- Choose '**all the math**' and complete the pre-test to find out what you can do
  - On the left, under '**Community**', click '**Coaches**'. Use your teacher's email address to add them as a coach

4.4 Demonstrating the first bank of training materials to students

Plan to spend some time showing students how to access the site. Take them through the steps for logging in and accessing the site, where to find the key features, and show them specifically how to complete the initial assessment and access the first set of materials you want them to use.

Many students will be very proficient, but it is important that they do not lose the initial momentum by becoming stuck with practicalities like finding the site, logging in or accessing the resources you wish them to use. Some time spent explaining the process will save time troubleshooting later and ensure that they can focus on the learning and practice rather than the technology.

4.5 Setting homework

Set the first homework task for your students. Make sure it is clear how this is going to be used in future lessons, and what the expectations are in terms of time. Reiterate the purpose of completing tasks as homework and how this might differ from the conventional homework they are accustomed to.

Identify the resources you wish to set as homework using the curriculum mapping documents. Decide whether you will use other resources during class or focus the use of the Khan Academy site on homework.

For the first homework, think carefully about how much is achievable, bearing in mind students will not be familiar with the system. It is important to set a realistic amount of work to demonstrate the purpose of the system, so to simply log in would not be enough, but not so much that they feel it is onerous and lose enthusiasm. Give them some guidance on getting over common technical problems.

There are several ways to assign homework to students as detailed below.

- Use the built-in recommendation tool on the Khan Academy site to 'recommend' the resource to your students. It will then appear as the first item they should complete in their dashboard
  - For specific steps on how to make recomendations to students, please see this guide and video on the Khan Academy website: **www.khanacademy.org/coach-res/reference-for-coaches/how-to/a/make-a-recommendation**.
- Identify the topic or video using the curriculum map and show the students the area where they need to access it on the site, ensuring they record it in their homework diary, work planner or notebook.
- Use the hyperlink or URL for the required resource and send it to students via email or by posting it on the school's virtual learning environment or website.

4.6 Setting up classes

Once your students have set up their accounts, you will need to add them to classes to organise the feedback you get from the site and assign them learning tasks.

Log into the Khan Academy site and click '**Coach**' on the menu at the top.

Go to '**Manage Students**' and then '**New Class**'. Set up the name of your class.

Go to '**Manage Students**' and then '**All Students**'.

Tick the students you want to be allocated to this class and then click '**Add To Class**', choosing the class you wish to add them to.

4.7 Reviewing students' performance

All activity on the site by your students is tracked and recorded so that you can gain insights into the learning that is happening. The intention is that you can use this data to see how your students are progressing in their independent learning and use this to influence the homework you set them, and the work you do in class.

To access the data, click on the '**Coach**' menu. You can then explore the data on student learning presented in several ways as detailed below.

- **Student Progress**
  - This shows the overall progress of your class through the Khan Academy Math organised by groups and individual students. You can also delve into individual student progress by clicking on their name.
- **Skill Progress**
  - This displays the data organised by the different areas of mathematics covered, and shows which students have demonstrated mastery of an area or are struggling.

- **Grid**
  - This displays a visual record matching student names with skills they have mastered or are struggling with, which is a useful, quick reference as to how the class is doing.
- **Activity**
  - This shows the resources students have accessed and the time they have spent on them. It is a useful page for discovering how much students are using the site.
- **Real Time**
  - This displays which students are using the site at this moment in time.

At first, the 'Activity' page is useful for monitoring what students are doing on the site, and making sure they have completed the homework you have set. It is a good idea to take a look at this page shortly before a lesson to make sure that they have covered the areas you have asked them to.

Once you and the students are more used to using the site, you can begin to delve deeper into the data to explore which areas they are mastering and which they are struggling with.

Using the 'Skill Progress' section, you can look at the area that corresponds with your learning objectives whilst planning. This will allow you to explore how well the students are doing in these areas and plan the learning accordingly. When planning a lesson, find the corresponding area, or areas, which they would need background understanding of for success in your lesson.

You might notice that students have not understood an underlying concept they need in order to be successful in the learning you have planned for the next lesson. To address this, you could recommend the class use the resources relating to that area in order to prepare.

As you use the site it may become apparent that different students are progressing at different rates, or need a more personalised approach. In this case, the 'Student Progress' or 'Grid' pages are useful tools as they allow you to analyse the learning of individual students and recommend areas they need to work on. This allows you to create a personalised approach to learning based on information gained from their work outside of school, as well as your own assessments of their work in lessons.

You may find different groups in your class need different approaches or recommendations. If so, you could create a new 'class' for each ability group within the class. This would allow you to 'recommend' tasks to each group separately using the procedure for making recommendations which is explained on the Khan Academy website here:

www.khanacademy.org/coach-res/reference-for-coaches/how-to/a/make-a-recommendation

Please be aware that the data represented here will be minimal at first and grow as the students use the system more. At first, you will have little to go on but, after a week or so of using the site, when the students have completed more work, the system will have much better data on how your students are progressing.

In order to get a feel for the data provided, we recommend that you take a look at the coach reports demo. This shows a class of 'dummy data' you can explore, and it is available at the link below.

www.khanacademy.org/coach/demo

4.8 Providing targeted support for learners in the classroom

The flipped learning model was originally intended to free up time in class from direct instruction for coaching students through difficulties and practising skills. By using the video resources as homework before the lesson, you could dedicate more of the lesson time to active learning as the students will have already been presented with the content.

With the exercises and analytics provided by the Khan Academy website, it is also possible to focus in on the areas in which most students need face-to-face coaching, discussion and support, and dedicate lesson time to addressing these areas. In traditional models of teaching, students can complete many exercises before you are able to identify where they face challenges. However, when they complete the Khan Academy exercises independently, you can arrive at the lesson knowing their areas of strength and weakness from the reports.

There are various different approaches to using these resources you could take:

- Set a video as homework, begin the lesson by asking students to identify what they did and did not understand, and focus teaching on exploring the areas of difficulty.
- Set a video as homework and ask students to explain what they learnt to each other before completing further practice.
- Set a video as homework and at the start of the lesson move straight into problems based on what the students will have learned at home.
- Focus homework on direct instruction through video, and class work on coaching students through exercises.
- Set video and exercises as homework. Use the data and reports the night before the lesson to design problems and class discussions to address the areas students are struggling with.
- Use the Khan Academy resources in lessons allowing students to move through them at their own pace, treating you as a coach who they can come to when they struggle.
- Use the Khan Academy as an independent resource for homework, encouraging students to identify areas of mathematics they need to continue to practise and develop.
- Encourage students to use the Khan Academy as a reference when they need to learn or recap a particular skill. This could be combined with applied problem-solving activities, where they need to locate resources in order to learn the skills needed to solve the problem.

There are many different ways these resources could be used, and this will depend both on your approach to teaching, and your students' approach to learning. For more on how our research schools chose to use the resources, please see our accompanying research report.

4.9 Completion of homework

A key aspect of flipped learning approaches is the fact that homework closely feeds into class work. The homework can become an important requirement for the success of a lesson. Therefore, it is important that students are conscientious about completing the homework you set.

We recommend explaining and discussing the purpose of homework with the students at the start of the project and regularly reiterating this. For students who are used to seeing homework as 'extra practice', rather than something they will struggle without, this can be a shift. Explaining how homework will link with class work can help them to understand its importance, and increase the chances of them completing it.

Having high expectations for the completion of homework and reiterating these regularly is also important. Students need to feel that it is important to complete their homework, and you may wish to integrate this into your school's rewards and sanctions systems.

For some classes, this can be a challenge, and some teachers approach it by providing some access to computers in their class for students who have not completed homework to catch up. Providing some access to computers outside of school time, such as homework clubs, can also help.

With a clear purpose and high expectations, added to the fact that students often find the Khan Academy resources engaging, many teachers in our research had few problems with non-completion of homework. However, at first, it is always a good idea to have a 'back-up plan' that can ensure the success of your lessons even if students struggle with the homework whilst they are adapting to the new approach.

4.10 Reviewing and revising your approach

To develop your use of the flipped learning resources in ways that best support your students and your teaching, it is important to continually review how you are using the system and make any necessary adaptations.

At first, it will probably be more practical points that emerge, but, as you and your class become more used to the site, you may wish to review the impact it is having on learning and adapt your use of it to best facilitate this.

There are some key questions that teachers in our trial found it useful to regularly reflect on:

- Are all students accessing the website or are any having difficulties?
- How is set homework contributing to class work?
- Are students using the site independently?
- What is the performance data telling you about how the students are learning?
- How is the use of the site influencing your planning?
- How is the use of the site influencing your assessment of student learning?
- How aware are the students of how well they are doing?
- What phases of the learning process is the use of the site contributing to? For example, teaching of new learning, practice and consolidation, assessment for learning, summative assessment.

4.11 Summary of the process

As the project develops, you will take the use of flipped learning in your own direction, but the above instructions have been designed to help you and your students get to grips with it quickly and easily.

In summary:

1. Keep the purpose in mind.
2. Define and record your intended outcomes.
3. Introduce the purpose and the site to students.
4. Complete student sign-ups to the site.
5. Allow students time to complete the pre-test.
6. Demonstrate how you want them to use the site.
7. Set homework tasks.
8. Review students' performance.
9. Plan and provide targeted support.
10. Review and revise your approach.

4.12 Model lesson process

What does Flipped Learning look like in practice? Day-to-day use could take the shape of the following process:

Planning

Once you have identified which aspects of the curriculum you will be covering, use the curriculum mapping documents to select relevant sections of the Khan Academy resources to use.

Setting homework

At the end of a lesson, set the relevant sections of the Khan Academy resources for the students to work through. In the traditional flipped learning model, these would be video resources teaching new concepts and replace the traditional 'teacher led' section at the start of a lesson.

Before the lesson

Review the data on the site to check which students have accessed which resources and, if you have set exercises, how they have done.

During the lesson

Review any areas the students have found difficult. Set them problems for practice or consolidation and coach them through difficulties. Move towards more complex problems, or those that are applied in an unfamiliar context.

Setting subsequent homework

The sequence then repeats, with you setting the next homework to look at resources relating to the next area of learning for the students. You may wish to do this at the end of the lesson, or take some time to review afterwards and then send the homework out to the students. The Khan Academy website has a feature you can use to send or 'recommend' a resource to your classes.

Repeat the process

PART 5

Key links and resources

The Khan Academy site: **www.khanacademy.org**

Curriculum mapping documents for the National Curriculum (England)

Curriculum mapping documents for Curriculum for Excellence (Scotland)

Both available at **www.nesta.org.uk/flipped-learning**.

The Khan Academy Coach resources: **www.khanacademy.org/coach-res**

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