

Unit 7 Mathematics

I Teaching Objectives

After learning Unit 7, students (Ss) are expected to develop the following academic skills and knowledge:

Professional knowledge	<ul style="list-style-type: none">• Know more about the use of mathematics in modern life• Think critically about the predictive functions of mathematics education
Reading	<ul style="list-style-type: none">• Summarize the main idea of a text and identify essential supporting points• Understand difficult sentences (e.g. sentences with abstract meaning or ambiguous reference)• Analyze complex or controversial issues critically (e.g. to form a balanced view of mathematics and its implications)
Viewing	Listen for stressed words
Speaking	Make a counterargument and emphasize a point
Writing	<ul style="list-style-type: none">• Familiarize yourselves with the “describing a problem” and “proposing solutions” pattern of an academic essay• Learning to use hedging strategies to avoid over-generalizing
Researching	Learn to work in groups, work out a result based on a given model, and report the findings to the class
Academic language and discourse	<ul style="list-style-type: none">• Acquire some specialized vocabulary of mathematics• Learn to use words or phrases indicating hedging• Comprehend stylistic differences between formal and informal English and acquire some formal expressions

II Teaching Activities and Resources

Reading

Text A

Lead-in

Teaching Steps

Put Ss into pairs and ask them to do the task in **Lead-in**. Then choose several Ss to share their answers with the whole class.

Answer Keys (*Suggested Answers*)

- Analyzing statistics collected from questionnaires
- Conducting experiments and analyzing the data
- Purchasing financial products

Text Analysis

Teaching Steps

1. Overview

Let Ss preview Text A before class. An alternative plan is to allocate some time for Ss to read Text A quickly in class. Then invite several Ss to summarize the main idea.

2. In-Depth Analysis

- 1) Show Ss the following words and invite them to share their own understandings with the class. Provide additional information in **Supplementary Information** when necessary.
 - Fibonacci sequence
 - decimal place
 - Stephen Baker and *The Numerati*
 - Acronym and Initialism
- 2) Explain some important language points in **Language Support** to Ss.
- 3) Discuss with Ss the nature and predictive function of mathematics in the author's eyes by doing **Task 1** in **Critical reading and thinking**.
- 4) Ask Ss to work in pairs on some of the questions about mathematics by doing **Task 2** in **Critical reading and thinking**. Call on some Ss to report their answers to the class.

Supplementary Information

1. Fibonacci sequence

Fibonacci sequence is often observed in the geometry of plants such as flowers

and fruit with regard to their recurrent structures and forms. For instance, Fibonacci sequence is used to study and indicate the arrangement of leaves, branches, flowers or seeds in plants, highlighting the existence of regular patterns. Fibonacci sequence is also closely related to the Golden Ratio (approximately noted as 1.168), which not only frequently occurs in nature, but is widely used to achieve aesthetic perfection in artworks, such as sculptures and paintings.

2. **Stephen Baker and *The Numerati***

Stephen Baker is an American journalist, non-fiction author and novelist who often explores themes concerning data and technology. *The Numerati* is a non-fiction book written by Stephen Baker. In this book, Baker discusses the increasing role that data-mining plays in politics, business, law enforcement, etc. on the basis of interviews with the numerati, which refers to people who are developing and using technologies to analyze and characterize our everyday actions. The book shows that data-mining can be used to predict outcomes and influence human behavior.

3. **Acronym and Initialism**

Acronym and Initialism are two types of abbreviation. Acronyms are pronounced as a whole word (e.g. NASA) while Initialisms are pronounced one letter at a time (e.g. FBI). In this text, an example of Acronym is ASCII, and CCTV is a typical example of Initialism.

Language Support

1. **What if those strings of numbers are records of the things you've bought, places you've traveled to, websites you've visited, parties you've voted for?** (Para. 3)

此处作者为了引起读者注意，营造交互感，使用了偏对话体的文风。实际上在学术英语的书写中，我们会尽量避免使用反问句及缩略形式(e.g. you've)。

2. **Until recently, the abstract language of mathematics seemed to have no relevance to the murky worlds of consumer trends, political preferences and dating.** (Para. 4)

have relevance to / be relevant (to)可以用来表示两者之间的关系，如需表达关系的密切程度，可以在relevance前加入direct / high / particular等形容词，或在relevant前加入这些形容词的副词形式。

e.g. *Yet for all that, Reagan was not without experience **highly relevant** to the demands of executive leadership in the 1980s.*

*Her contribution in discussion of ward management will **be particularly relevant** and useful.*

*Their suggestions **have very little relevance** to our problems.*

3. **For example, Baker talks to one of the numerati, Dave Morgan of AOL, who picked up a correlation between people visiting the Alamo Rent A Car website and surfing romantic movie sites.** (Para. 7)

使用who和which的定语从句可以根据它们和先行词的关系分为限定性定语从句 (Restrictive Adjective Clauses) 和非限定性定语从句 (Nonrestrictive

Adjective Clauses)。限定性定语从句和先行词关系密切，若省去，则会影响句子的含义；非限定性定语从句和先行词关系不密切，可以省去而不影响句子的含义。判断时可以看先行词是否具体：如果是具体的，则用非限定性定语从句。写法上，前者不需要在who / which前加逗号，后者通常需要加逗号。以下举两例：

a. The girl won a prize.

The girl *who sang a solo* won the prize.

在这组句子中，我们不知道 the girl 具体是谁，第二句所加的修饰内容旨在帮助读者明确 the girl（先行词）的身份，因此这里使用限定性定语从句，关系代词前不需要加逗号。

b. Mary won a prize.

Mary, *who sang a solo*, won the prize.

在这组句子中，我们已经知道是一个叫Mary的女孩得了奖，第二句所加的修饰内容仅仅是附加信息，因此这里使用非限定性定语从句，关系代词前需要加逗号。

类似地，我们已经知道课文中的Dave Morgan的具体身份（AOL的工作人员），因此定语从句中的内容只是附加信息，使用非限定性定语从句。

4. It isn't an obvious match; only in retrospect could it be traced to an escapist tendency. (Para. 7)

in retrospect: when looking back in time 回顾往事

e.g. I'm sure my university days seem happier in retrospect than they really were.

Answer Keys

Critical reading and thinking

Task 1 / Overview

1. Mathematics is the science about spotting patterns, detecting the underlying logic in the seemingly random and chaotic world, and using this information to predict future behavior.
2. 1) inanimate objects; the orbit of planets or the weather
2) human behavior; buying things, traveling, visiting websites, voting for parties
3. Digitization enables mathematics to make predictions other than the traditional types.
4. 1) find all sorts of clever ways to exploit the identified pattern of the consumers to bombard them with offers for their preferences
2) pair one with a suitable partner
5. 1) sinister magic; civil liberties
2) the elderly; target individuals on issues that they care about

Task 2 / Points for discussion (Suggested Answers)

1. Browsing history, age, nationality, gender, etc.

2. They love learning English, reading, pets, etc.
3. 1) I prefer falling in love randomly, because I still believe the romance of “love at first sight.” I would rather be ruled by my intuition and feelings than get manipulated by data.
2) I prefer having a mathematical model looking for a suitable partner for me, because it can save me a lot of time and energy, especially in this age when it becomes increasingly difficult to encounter interesting people.

Language building-up

Answer keys

Task 1 / Specialized vocabulary

1

1. b 2. d 3. f 4. a 5. g 6. c 7. e 8. h

2

1. decimal expansion	2. digital trail
3. Infinity	4. underlying logic
5. decimal places	6. digital revolution
7. genetically modified	8. loyalty card

Task 2 / Academic vocabulary

1. abstract	2. modified
3. fluctuation(s)	4. inevitably
5. random	6. accuracy
7. code	8. significant
9. convert	10. identify

Task 3 / Collocations

1. in retrospect	2. decode it / crack the code
3. spelled out	4. has high relevance to / is highly relevant to
5. in no position to	6. predict / make predictions about
7. test your knowledge on mathematics / test your mathematical knowledge	
8. finds that there is a correlation between banning mobile phones in schools and better performance in examinations	

Task 4 / Formal English

1. implications
2. There are clear issues of civil liberties at stake
3. consent
4. is balanced
5. triggering a hasty visit from a doctor

Translation of Text A

他们把我们都看透了

你能预测这些数字串中的下一个数字会是什么吗？

123454321234543212 ...

11235813213455 ...

993751058209749 ...

第一个数列有明显的节奏。第二个数列有点棘手，但仔细观察你就可能发现，数字串中的前两个数字之和是下一个数字。这就是斐波纳契数列，自然界最喜欢的一组数列，也是丹·布朗的小说《达·芬奇密码》中第一个被破解的密码。第三个数列要复杂得多。起初这个数列看起来是随机的，但如果具备正确的知识，你就可能认出它是圆周率十进制展开的一部分，数字串从小数点后第 44 位开始。一旦你知道了这一点，你就可以完全掌握这个数列并预测它延伸到无穷大过程中的每一个数字变化。

数学在看似随机和混乱的世界中找到基本逻辑，发现规律，并用这些信息来预测未来行为。传统上，数学被用来预测无生命的事物，如行星轨道或天气。但正如斯蒂芬·贝克在《当我们变成一堆数字》一书中指出的，数学家们越来越多地将注意力转移到人类行为上。如果这些数字串记录的是你买过的东西、去过的地方、访问过的网站、投过票的政党，那会怎样？找到数字中的规律，数学家就能以惊人的准确度预测你的下一步行动。“数字天才”是贝克对这些通过数字解读我们行为的群体的称呼。他这本书探索了这些数字天才的生活，并试图分析他们已经变得多么强大。

以前，数学的抽象语言似乎与消费趋势、政治偏好和约会等错综复杂的领域毫无关系。数字化的趋势使数字天才的崛起成为可能。今天，我们每个人无论走到哪里都会留下大量的数字痕迹。我们所做的一切——从访问网站到给朋友发短信——几乎都被转化为 1 和 0。这些数字被存储在某个地方，并提供给那些知道如何访问它们的人。例如，每次我们在谷歌中输入搜索内容时，一个名为 ASCII 的简单代码就会将我们输入的每个字母转换为一串 0 和 1，并通过互联网发送出去。

当我们在商店结账处卸空购物车时，商品的条形码会被我们的会员卡存储起来，记录下我们的饮食习惯。当我们走在路上，我们的行踪很可能被闭路电视跟踪，转换成数字代码并存储在电脑主机上。甚至我们的心情和想法也会被我们所喜爱和依赖的技术转化为 0 和 1，因为成千上万的人将自己的思想状态倾诉到博客上。忘掉占星术和星象吧，你的未来已经被编码在你留下的数字痕迹里了。

这些数据踪迹对于有能力解读的人来说就是金矿。广告商和政治家一直梦想着能够根据个人的详细信息精准地推送对应的产品或消息。现在，这个梦想正在成为现实。通过数学分析方法，数学家们可以将具有共同兴趣和热情的人聚集在

一起，创建更小、更具体的目标群体。

例如，贝克与一位数字天才——美国在线的戴夫·摩根交谈，后者发现浏览阿拉莫租车公司网站和浪漫电影网站的人群存在相关性。这个相关性并不明显，只有在回头来看时，才有可能追溯到两者都有一种逃避现实的倾向。但一旦发现了这种规律，广告商就可以找到各种巧妙的方式来利用它——例如，向这一特定群体发送大量的乡村酒店周末度假优惠信息。

贝克认为，从工作场所到投票站，从医疗保健到反恐，数字天才在一系列领域已经变得非常强大。他甚至用数学来测试一家婚恋中介机构能否将他和他的妻子配对；当他最终取消要求找年轻几十岁的伴侣的勾选框时，贝克夫人出现在名单的最前面。不可否认，数字革命为数学家开辟了令人兴奋的新领域。数字天才不是幻想出来的，而是真实存在的。贝克向我们讲述了一个重要但却经常被忽视的现象。他的书因而变得迫切且激动人心。

但这本书也有重大缺陷。贝克华而不实的记者风格让人在读了一段时间后心生厌烦——尤其是当我们被迫读到他在咖啡馆里又喝了一杯咖啡，等待下一个采访对象的时候。也许是因为我是个数学方面的书呆子，我希望书中能有更多关于数学的细节。贝克的数学描述往往是肤浅的；事实上，他似乎认为数学不过是魔法。他笔下的数字天才就像是拥有神秘知识的巫师，而不是掌握着理性分析工具的科学家。这种春秋笔法使得书中的数字天才给人一种邪恶的感觉。

当贝克在书中将侧重点转向数字天才活动的政治含义时，这本书变得更加有趣了。这显然涉及公民自由和知情权的问题。我们大多数人都不知道自己的生活多大程度上被跟踪了。一旦知道了真实情况，我们可能会被吓坏。与此同时，我们也很难否认数字天才们通过分析普通人的数字痕迹做了很多好事。贝克在书中的分析相当全面，他阐述了为什么我们应该感谢数字天才，也说明了为什么我们应该有所担忧。例如，数字天才用他们的数学技能进行医疗保健监测；老年人家里配备的相关装置会记录体重或行动能力，体重的波动或行动能力的下降会触发医生的巡查问诊。如果你成为一家交友机构的会员，你也会想利用数学天才的技能来寻找完美的伴侣。再则，正如贝克在其关于民调人员利用数字天才的章节中所指出的那样，如果政治家们通过数字分析手段可以更精准地知道民众的兴趣所在并与之讨论，而不是简单地对民众重复陈词滥调，那么这种对数字的运用就是一件好事。

我们的社会有一种用怀疑的眼光看待科学的倾向，于是有了纳米机器人潜入人体搞乱我们的 DNA、欧洲核子研究中心的大型强子对撞机中的黑洞吞噬宇宙、转基因作物席卷世界并毁灭一切的故事。所有的科学进步都包含迈向未知的步伐，而探索未知会不可避免地带来风险。正因如此，像贝克这本书这样的作品很有价值。一旦你熟悉了科学的运作原理及其影响，你就能更好地区分这是怀着邪恶目的的发展还是别有用心的炒作。

Text B

Text Analysis

Teaching Steps

1. Lead-in

Ask Ss to share their experience of learning mathematics and their opinions on whether it should be a required course in college.

2. Overview

Help Ss to summarize the major argumentations raised in Text B by doing **Task 1 of Critical reading and thinking**.

3. In-Depth Analysis

- 1) Invite Ss to reflect on the objectives of mathematics education and the importance of studying mathematics. Provide supplementary information when necessary.
- 2) Invite Ss to work in pairs on some of the questions about mathematics by doing **Task 1 and Task 2 in Language building-up**. Call on some Ss to report their answers to the class.

Supplementary Information

1. The objectives of mathematics education

At different times and in different countries, mathematics education has attempted to achieve various objectives, for example:

- Teaching numerical skills to all students
- Teaching practical mathematics (arithmetic, elementary algebra, plane and solid geometry, trigonometry) to most students to prepare them for a trade or craft
- Teaching selected areas of mathematics (for example, calculus) as an example of the modern intellectual achievements
- Teaching advanced mathematics to those who wish to pursue a job in science, technology, engineering ...

2. The importance of studying mathematics

The study of mathematics can be rewarding whatever future career we want to pursue. As we all know, knowledge of mathematics is essential for many areas of science, such as economics, medicine and engineering. Moreover, mathematics can teach us analytical and quantitative skills, which are important for a wide range of jobs and may determine whether we will be successful in the job or not, especially when decision making and quantitative activities are involved.

3. Paul Halmos

Paul Halmos was a major figure in twentieth century mathematics, and a famed author, editor, teacher, and speaker of distinction. He was thoroughly dedicated to mathematics, and he loved communicating it to others. He argued that “research is formalized curiosity,” and that teaching should be about asking questions, not

giving answers. As a noted teacher, he won the prestigious MAA Award for Distinguished College or University Teaching of Mathematics.

Language Support

1. To select medical students we should look at **portfolios**, early internships, content-specific reasoning tasks, and judgments of their motivation for their chosen profession. (Para. 1)

portfolio: a collection of documents, pictures, etc. that represent a person's work
作品集

e.g. She's trying to build up a portfolio of work to show during job interviews.

这一句出现了几项在面试中时常会被考虑的个人材料。其中，portfolio 一词除了“作品集”的义项之外还有其他常用释义，如：

1) a large flat case used especially for carrying drawings, documents etc. 公事包；文件夹

e.g. John often felt depressed after dragging his portfolio around various agencies.

2) the area of responsibility that a particular government official has 大臣或部长的职责

e.g. He has held the defence portfolio since the first free election.

3) a collection of stocks owned by a particular person or company (某人或某公司持有的) 有价证券，投资组合

e.g. Short-term securities can also be held as part of an investment portfolio.

还有一个与之近似的词汇：

profile:

1) a description of a person, group, or organization that contains all the details that someone needs (人、团体或组织的) 简介，概况

e.g. A newspaper published profiles of the candidates.

2) the shape of someone's face when you look at them from the side (头部的) 侧面，侧影

e.g. She turned his head so she could see his profile.

3) the shape of the edge of sth. (某物的) 轮廓

e.g. Amid the smoke, one could see the unmistakable profile of the Claremont Hotel.

2. An American mathematician **of some note** was returning from a trip abroad and had to go through customs. (Para. 2)

1) of (some) note: important or famous 重要的；著名的

e.g. Several writers of note will be at the conference.

2) customs *n. (pl.)* a government department that collects taxes on goods that people bring into a country 海关

e.g. Delays are often reported by passengers waiting to clear customs.

需要特别注意的是，customs 指“海关”时需用复数形式。

3) 本句中，“was returning”是用过去进行时表过去将来，不能将其理解为“正在返回”。

3. She presents an **alternative** approach that recognizes diversity in interests, talents, plans, and hopes among learners. (Para. 4)

alternative 是一个常用但易混淆的词:

alternative:

1) *adj.* different from something else and able to be used instead of it 供替代的; 供选择的

e.g. We are now looking for an alternative way to solve this problem.

2) *n.* something that you can choose to do or use instead of something else 可供选择的事物

[+to]

e.g. Is there a viable alternative to the present system?

have no / little alternative (but to do something): If you have no or little alternative but to do something, you cannot avoid doing it 除……外别无选择

e.g. The surgery was very expensive, so I had no alternative but to sell my car.

与 alternative 近似, alternate 也有多种词性和词义:

1) *v.* if two things alternate or you alternate them, they change from one to the other in a repeated pattern (使) 轮流, 交替

e.g. Her emotions alternated between outrage and sympathy.

2) *adj.*

i) happening or coming one after another, in a regular pattern 交替的; 轮流的

e.g. The walls were painted with alternate stripes of yellow and green.

ii) happening on one day, week etc., but not on the day, week etc. that immediately follows (日期、星期等) 间隔的

e.g. I go and visit him on alternate weekends.

3) *n.* someone who takes the place of another person 替补者; 候补者

e.g. Madsen is listed as an alternate to tonight's starting pitcher.

需要注意的是, 当二者均作为名词时, alternative 比 alternate 多了一层“选择”的意思, 如: *The starting pitcher was injured during the game, so the team had no **alternative** but to put the unseasoned **alternate** on the field.*

4. She writes, “We are overly reluctant to face the fact that human interests vary **widely** and that many highly intelligent people are just not attracted to mathematics. (Para. 5)

副词 widely 可表示抽象意义上的“广泛地; 普遍地”。需要注意的是, wide 本身也可以作副词, 但表示的是物理/空间意义上的“充分地张开”。

*e.g. At one time it was **widely** believed that the sun revolved around the Earth.*

*The door was **wide** open when we got here.*

类似的组词还有 close / closely, hard / hardly 等。

5. ... or what evils are visited on the next generation as a result of our **benevolent insistence**. (Para. 5)

benevolent 表示“kind and generous”。其中, “bene”来自拉丁词源, 意为“well”。我们可以由此联想到其他带有“bene”的, 与“好意”有关的词, 如: beneficial、beneficent、beneficiary 等。但本文中作者显然在用反语, 不仅表示“好心办

坏事”的意思，可能还指不区别学生资质，无差别地要求所有学生都学数学的教育政策是一种懒政。

Answer Keys

Task / Overview

trapped by a counterproductive filter
because students who are forced to learn mathematics are deprived of the first prerequisite—intellectual curiosity
human interests vary widely and that many highly intelligent people are just not attracted to mathematics
all students to “think like a mathematician”
to use math for their own purposes
more attentive and helpful

Language building-up

Answer Keys

Task 1 / Academic vocabulary

- | | |
|------------------|------------------|
| 1. objective | 2. alternative |
| 3. commitment | 4. erode |
| 5. motivation(s) | 6. proportions |
| 7. medical | 8. enforcement |
| 9. appreciation | 10. intervention |

Task 2 / Collocations

- | | |
|-------------------------------------|--------------------------|
| 1. elicit responses from | 2. jumped at the chance |
| 3. took me aside | 4. under coercion |
| 5. force her opinion down my throat | 6. make a diagnosis |
| 7. threw up his hands | 8. serves the purpose of |

Researching

Teaching Steps

1. Guide Ss to work in groups of 4-5 and search for the information of credit scoring.
2. Invite students to share the information related to the four prompts
3. Encourage students organize the obtained information and write a short report about credit scores.
4. Invite some groups to report their findings to the class.

Answer Keys

1. FICO score is grouped into five categories: payment history (35%), amounts owed (30%), length of credit history (15%), new credit (10%) and credit mix

(10%).

2. Social behavior data include the hallmarks of social behavior for individuals, such as how individuals manage their online social activity, how often they consume fast food, or even whether they pick up after their dogs.
3. “Socioeconomic Group Classification Based on User Features” is a patent developed by Facebook (*editor’s notes*: it is now Meta) in 2018. This online system uses classifiers to predict the socioeconomic group of users of the online system. The classifiers use models that are trained using features based on global information about a population of users such as demographic information, device ownership, internet usage, household data, and socioeconomic status. The global information can be aggregated from market research questionnaires and provided to the online system. The classifiers input information about a user and output a probability that the user belongs to a given socioeconomic group. The input information is based on a user profile on the online system associated with the user as well as actions performed by the user on the online system. Thus, the online system can predict the user’s socioeconomic group without using the user’s income information. The online system can generate content for presentation to the user based on the predicted socioeconomic group.
4. 1) I agree with the author. With the rise of online shopping and online payment, a large body of data recording consumer behavior is available to analysts, which makes mathematical techniques a requisite for the study of consumer trends. Political preferences are influenced by digitization as well. Researchers have found that there are positive relationships between digital media use and political participation and knowledge. In the UK, the growth in digitization increases support for the Conservative Party, the incumbent party, and voter turnout. Politicians need the help of mathematical models to target and analyze changes in public opinions. Concerning dating, the finding and matching process is moving online. Dating sites collect lots of personal information that requires proper arithmetic methods to match their users. Thus, the numerati are needed more than ever in this digital age.
2) I don’t agree with the author. Researchers and analysts have long been using mathematics in their studies of consumer behavior, political preferences, dating activities, etc. For example, Prescriptive Cognitive Models, which can be expressed algebraically, were first developed in the 1960s when marketing researchers increasingly focused on beliefs and attitudes as determinants of consumer buying behavior. Digitization might not be the most important reason for the rise of the numerati.

Translation of Text B

大学数学教育

我们相信，在大学阶段，如果一个人不懂一些数学思维及其对科学的重要性，这个人就不能算是受过教育。然而，大学对学生的数学要求通常没有起到这样的教育作用。大多数学生都会被分入所谓学习微积分前的必修序列——即复习高中

代数和三角学——但大多数学生都止步于此，从未选修过微积分。在选修微积分的学生中，其选修原因往往是医学院或商学院有这方面的入学要求。将微积分作为进入法律、医学或建筑学院学习的先决条件，这种要求应该被重新考虑。当我们问这些学院的教师“你希望你的学生知道微积分的什么知识”时，他们一再回答：“这不重要！”这种“用数学筛选学生”的方法的优点可能是体现客观性，更容易被用来回应说他们有偏见或偏袒的指控。但是，根据与职业相关的能力高低和投入程度来评估医学院或商学院的申请人会更加理性和公平。例如，大多数医生需要具备做出诊断的能力。为此，他们需要从病人那里获取信息，吸收和应用医学研究的结果，并制定适当的治疗方案，监督其执行。由此看来，对于想要取得医学成就的人来说，语言和人际交往能力以及对科学的兴趣比微积分知识更为重要。为了选择医学生，我们应该看他们的作品集、实习经历、特定内容的推理任务以及对他们选择专业的动机的判断。用微积分来筛选学生是适得其反的。医师或企业家真正可能使用的数学——基础统计学以及用比率和比例进行计算——可以在本科或专业阶段专门为他们设计的课程中学习。

下面的一则轶事可能是无稽之谈，但很有启发意义。

一位著名的美国数学家从国外旅行归来。过海关时，美国海关官员问他在逗留的这一周里都做了些什么。数学家回答说参加了一个数学会议。海关官员就把这个人带到一边，扣留了他一段时间，问了一大堆繁琐的问题：他具体去了哪些地方，在旅途中做了什么。这位数学家一直紧张地看表，担心自己会错过转机航班。最后，海关人员问到了我们这位朋友每天晚餐吃了什么。数学家终于忍不住举起手来，大声说：“你为什么要这样对我？”海关官员笑着说：“啊！现在你知道我学微积分时的感受了吧。”

也许教授终于知道被微积分所困的学生的感受了。但当年的学生能理解教授的感受吗？有哪个数学家喜欢把自己的课题强行塞给那些只想得到及格分数、逃离无休止的讲课的被动受害者呢？保罗·哈尔莫斯写道：

一个班级的学生因为这样的要求而选修一门课程，这样的课堂真是可悲可叹……使得学习过程既愉快又有效的第一个前提条件是好奇心。一旦缺乏了好奇心，一切就都毁了。它毁了教学，毁了学习，毁了乐趣。我梦想中的理想大学充满了对知识富有好奇心的学生。他们中的一些人选修数学课程，只是因为他们想了解数学……他们自由地、自愿地来找我，并要求我教他们数学。哦，真高兴！如果真有这种事，我一定会跃跃欲试的。

现在的大学数学教育一定要这样吗？能不能换一种方式？内尔·诺丁斯就敢于拥有这样的梦想。诺丁斯在新泽西州的公立学校做了 23 年的小学、高中教师和管理人员。之后，她获得了博士学位，并在 1977 年至 1998 年担任斯坦福大学的教育学教授。她还担任过教育学院的代理院长，是美国教育哲学学会和约翰·杜威学会的前主席。她养育了 10 个孩子。诺丁斯提出了教育的另一种路径，即承认学习者之间兴趣、才能、计划和期望的多样性。

诺丁斯写道：“我们太不愿意面对这样一个事实：人类的兴趣千差万别，许多高智商的人就是不喜欢数学……我不知道由于我们对数学的执念，有多少人的才能和兴趣丧失了，多少人踌躇满志的自信心被削弱了，多少人养成了遇到数学就紧张的习惯，多少使之合理化的说法被编造出来；我也不知道我们善意的坚持给下一代带来了多少恶果。”我们同意她的观点，“道路”不应该有高低之分，只是不同而已；所有诚实的工作都应该得到尊重和尊严。

我们也不应该强迫所有学生“像数学家一样思考”。最好让学生学会像诺丁斯说的那样，为自己的目的使用数学。我们应该拒绝任何关于共同的普遍能力的假设而承认智力优势的多样性。诺丁斯甚至写道：“那些数学差的孩子，可能无论如何努力永远都不会理解代数和几何的孩子，我认为他们在任何重要的方面都不是残障的、低劣的，抑或是需要英勇的干预的。”她问道：“为什么一个想主修文学、艺术、戏剧、执法、历史或社会工作的学生要‘学习’代数和几何呢？……我开始怀疑，教每个人代数和几何是既浪费又轻率的。”

我们可以对那些真正对数学感兴趣的学生给予更多的关注和帮助。诺丁斯写道，和他们在一起，我们甚至可以“致力于更深层次的自我理解，讨论有时伴随着长时间智力工作的孤独以及理解数学问题后产生的快乐”。我们同意她的观点，这样的学生应该明白，他们的天赋并不比别人高一——只是不同而已。

诺丁斯代表学生所要求的，正是哈尔莫斯代表教师所要求的！她要求我们除了让学生掌握日常生存和有效推理所需的数学技能外，还要让学生遵循自己的兴趣和智力优势。我们同意她的观点。让学生在不同的情境中利用不同的兴趣来深化知识，这才是“算数”的教育根本。

Viewing

Teaching Steps

1. Ask Ss to read the information about how to listen for stressed words on Page 159.
2. Prepare Ss for viewing the mathematics-themed lecture by introducing the words in the Word Bank.
3. Let Ss watch the video clip and underline the stressed words in **Task 1**.
4. Lead Ss to watch the video clip again and complete **Task 2**.
5. Let Ss return to **Task 1** to reflect on whether the stressed words convey important messages.

Answer Keys

Task 1

When French mathematician Laurent Schwartz was in high school, he started to worry that he wasn't smart enough to solve math problems. Maybe you know a similar feeling. You sit down to take a math test, and you feel your heart beat faster and your palms start to sweat. You get butterflies in your stomach, and you can't concentrate.

This phenomenon is called math anxiety, and if it happens to you, you're not alone. Researchers think about 20% of the population suffers from it. Some psychologists even consider it a diagnosable condition. But having mathematical anxiety doesn't necessarily mean you're bad at math—not even close. Laurent Schwartz went on to win the Fields Medal, the highest award in mathematics.

Task 2

1. T
2. T
3. F
4. T
5. T
6. F
7. F

Script

Why do people get so anxious about math?
Orly Rubinsten

When French mathematician Laurent Schwartz was in high school, he started to worry that he wasn't smart enough to solve math problems. Maybe you know a similar feeling. You sit down to take a math test, and you feel your heart beat faster and your palms start to sweat. You get butterflies in your stomach, and you can't concentrate. This phenomenon is called math anxiety, and if it happens to you, you're not alone.

Researchers think about 20% of the population suffers from it. Some psychologists even consider it a diagnosable condition. But having mathematical anxiety doesn't necessarily mean you're bad at math—not even close. Laurent Schwartz went on to win the Fields Medal, the highest award in mathematics.

People might think that they're anxious about math because they're bad at it, but it's often the other way around. They're doing poorly in math because they're anxious about it. Some psychologists think that's because math anxiety decreases a cognitive resource called working memory. That's the short-term memory system that helps you organize the information you need to complete a task. Worrying about being able to solve math problems, or not doing well on a test, eats up working memory, leaving less of it available to tackle the math itself. People can suddenly struggle with even basic math skills, like arithmetic, that they've otherwise mastered.

Academic anxiety certainly isn't limited to math, but it does seem to happen much more frequently, and cause more harm in that subject. So why would that be? Researchers aren't yet sure, but some studies suggest that the way children are exposed to math by their parents and teachers play a large part. If parents talk about math like something challenging and unfamiliar, children can internalize that.

Teachers with math anxiety are also likely to spread it to their students. Pressure to solve problems quickly dials up stress even more.

And in some cultures, being good at math is a sign of being smart in general. When the stakes are that high, it's not surprising that students are anxious. Even Maryam Mirzakhani, an influential mathematician who was the first woman to win the Fields Medal, felt unconfident and lost interest in mathematics because her math teacher in middle school didn't think she was talented.

So if you experience mathematical anxiety, what can you do? Relaxation techniques, like short breathing exercises, have improved test performance in students with math anxiety. Writing down your worries can also help. This strategy may give you a chance to reevaluate a stressful experience, freeing up working memory. And if you have the chance, physical activity, like a brisk walk, deepens breathing and helps relieve muscle tension, preventing anxiety from building. You can also use your knowledge about the brain to change your mindset. The brain is flexible, and the areas involved in math skills can always grow and develop. This is a psychological principle called the growth mindset. Thinking of yourself as someone who can grow and improve can actually help you grow and improve. If you're a teacher or parent of young children, try being playful with math and focusing on the creative aspects. That can build the numerical skills that help students approach math with confidence later on. Importantly, you should give children the time and space to work through their answers. And if you're an administrator, make sure your teachers have the positive attitudes and mathematical confidence necessary to inspire confidence in all of their students. Also, don't let anyone spread the myth that boys are innately better than girls at math. That is completely false.

If you experience math anxiety, it may not help to just know that math anxiety exists. Or perhaps it's reassuring to put a name to the problem. Regardless, if you take a look around yourself, the odds are good that you'll see someone experiencing the same thing as you. Just remember that the anxiety is not a reflection of your ability, but it is something you can conquer with time and awareness.

Speaking

Teaching Steps

1. Guide Ss through the instructions on how to make a counterargument.
2. Draw Ss' attention to the language patterns of making a counterargument and emphasizing a point.
3. Ask Ss to work in groups and make a counterargument entitled "We Don't Want Them to Figure Us Out." Remind them to try to use the language patterns provided. Invite at least one group to present their counterargument in class.
4. Comment on Ss' presentation, and invite some Ss to give peer feedback.

Writing

Teaching Steps

1. Draw Ss' attention to the strategies for describing a problem and explaining solutions. Probe if Ss have other good suggestions to offer and let Ss share their ideas.
2. Guide Ss to learn to use hedged language in academic writing.
3. Ask Ss to complete **Task 2** and share their answers.
4. Ask Ss to complete **Task 1** and give feedback next time. Select some sample essays to discuss in class.

Answer Keys

1. Baker's mathematical descriptions are often superficial, and indeed he seems to regard the math as little more than magic. (Para. 9, Text A)
2. Most of us have no idea how much of our lives are being tracked. If we did, we would probably be horrified. (Para. 10, Text A)
3. The kind of mathematics that physicians or entrepreneurs really are likely to use—basic statistics, and calculating with ratios and proportions—could be provided in a course specifically designed for them ... (Para. 1, Text B)
4. We could then be more attentive and helpful to students genuinely interested in math. (Para. 7, Text B)