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SeEd 4105
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Text Set: Mmm, Pi

This text set about pi is designed for secondary students, and could be used with such courses as geometry, trigonometry, pre-calculus, or some combination of these. When used in a more advanced class, it could be used as a review technique or as the launching pad, so to speak, for deep discussion about the many, varied uses for pi. Many of the students will have some small concept of this interesting number; by reading from within this text set, the students will gain a stronger basis of knowledge about this unique number.

This text set varies between books, chapters, articles, and even children's literature, and are organized as such. The pieces differ in tone and difficulty. Some contain an abundance of information about pi – allowing for the student to learn about that which most interests them, or potentially to gain quite an extensive knowledge of various aspects of pi. Others thoroughly review a particular aspect of pi. Each type is useful for accommodating a myriad of learning styles and preferences.

[[With this text set, I have included readability levels from both SMOG and Flesch-Kincaid for each text – not for the purpose of comparing SMOG and Flesch-Kincaid for a particular text, but for the purpose of comparing the overall range of difficulty for the text set. When discussing each text, I reference only one readability result.]]

Books:
1. Blatner, David. <u>The Joy of [Pi]</u>. 1st ed. New York: Walker and Company, 1997.

This delightful little square book of 121 pages sets out to cover some of the more intriguing or puzzling aspects of pi. Within the table of contents, chapter description often list questions about which the reader may have already wondered. *The Joy of [Pi]* discusses circle-squaring (then and now), pi digit approximation, a brief history, the symbol, the characteristics of pi, and memorization of pi. The text within is often presented in colourful text boxes and circles, with helpful and intriguing diagrams. Along the background of nearly every page, more digits of pi are listed in columns, ending on the last page with the 1 millionth digit. With this text, the students could have the option of selecting a few chapters that interest them, or read the entire text.

Blatner's *The Joy of [Pi]* is an engaging and not-too-difficult read. The readability level attained through SMOG suggests level 15; however, one has to take

into account the familiar, yet poly-syllabic words *circumference, approximation, mathematician, calculation, diameter, measurement, inscribed*, and *irrational*, as well as several proper names of mathematicians, all raise the SMOG calculations significantly.

(Flesch-Kincaid level: 12.0)
SMOG level: 15

2. Beckmann, Petr. A History of (Pi). 3rd ed. New York: St. Martin's Press, 1971.

Beckmann's *A History of (Pi)* is 189 pages long, and covers discoveries involving pi from the early Greeks to the current computer age. The history is full of helpful diagrams and pictures of the mathematicians who accomplished work with advancing knowledge of pi. A brief biographical vignette is often included for these mathematicians. In addition, Beckmann relates events otherwise occurring in the world at the time of different discoveries – making this text a great interdisciplinary text. Further, Beckmann admits to not being a historian, and provides fact and opinion alike [whilst still clearly separating the two], which will engage many students more than the 'dispassionate aloofness' genuine historians portray [as Beckman himself disparages].

Beckmann is also not a mathematician, and thus does not complicate his explanations with mathematical rigour, which should appeal to non-mathematical readers and students alike. Furthermore, Beckmann suggests to his readers that, if they find the math too difficult to follow in some areas, they should follow the practices of mathematicians who find the math too trivial: Skip it. This allows for considerable adjustment of the mathematical level of the text. Flesch-Kincaid provides a grade level of 11.4, which I believe to be fairly accurate. Again, familiar but poly-syllabic, long, and frequently appearing words such as *circumference, approximation, mathematician, calculation, diameter, measurement, inscribed*, and *irrational*, in addition to proper names of mathematicians, countries, cities, and universities all factor in to slightly raise the readability level.

Flesch-Kincaid level: 11.4
(SMOG level: 17)

Chapters:
3. Pappas, Theoni. "Probability and Pi" in The Joy of Mathematics. (pp. 18 – 19) 2nd ed. San Carlos, CA: World Wide Publishing / Tetra, 1991.

Pappas' 2-page segment on pi provides three examples of areas of mathematics in which pi has been found to be useful. She grabs attention with a Star Trek reference, and goes over pi's relation to geometry, calculus, and probability very briefly. She includes some history along with the intriguing results. Because it's so brief, it's a reading to whet the mathematical appetite of the students.

SMOG provides this text with a 16, which I believe to be inflated. Again, just because the text uses poly-syllabic words, such as those aforementioned, and contains slightly longer sentences to explain the meaning does not mean it is that difficult for students to read, especially when these are familiar words and ideas. I think students anywhere between 10th and 12th grade reading level could handle this text.

(Flesch-Kincaid level: 12.0)
SMOG level: 16

4. Schumer, Peter D.. "Chapter 11: Episodes in the Calculation of Pi" in <u>Mathematical Journeys</u>. (pp. 101 – 115) 1st ed. Hoboken, NJ: John Wiley & Sons, Inc., 2004.

Schumer's chapter on Pi is relatively short, but discusses in appropriate detail the calculational exploits of mathematicians from around the world and throughout the ages. Schumer makes special note of the differing methods these mathematicians use to calculate pi – particularly highlighting Ramanujan, who developed 30 different formulas for pi in the 20th century. The chapter ends with a few problems for reinforcing and extending the reader's knowledge. These problems range from algebra and geometry problems to trigonometry and calculus convergence problems, allowing for students of differing levels of comprehension to put their new-found knowledge into practice.

Flesch-Kincaid suggests level 10.0, with which I would agree. Schumer uses a combination of familiar and simpler terminology along with shorter sentence structures to help his readers to comprehend the material. There are a lot of mathematical equations to follow in the text, but they differ in level and area of math, such that the students should be able to find at least a few with which they can proceed.

Flesch-Kincaid level: 10.0
(SMOG level: 11.6)

5. Anderson, Marlow; Katz, Victor; and Robin Wilson, editors. "Liu Hui and the First Golden Age of Chinese Mathematics, Part 6: The Calculation of Pi" and "The Discovery of the Series Formula for Pi by Leibniz, Gregory and Nilakantha" in

<u>Sherlock Holmes in Babylon and Other Tales of Mathematical History</u>. (pp. 75 – 76; 111 – 121) 1st ed. The Mathematical Association of America, Incorporated, 2004.

In this collection of articles, the students have a choice between a section about Liu Hui's calculation of pi, an approximation not bettered for 1200 years, and an article about series formulae for pi, as developed by three different mathematicians. Here, it depends upon with which class the text set is being used. Students in geometry will have a better understanding of the former, but may get lost in the latter. Students in pre-calculus and trigonometry are more likely to understand the provided series formulae, with its talk of tangents, limits, and series. All should be able to follow the historical aspects, even if the math is slightly unclear.

These articles are a bit more math-heavy in content, and a tad drier, than some of the other texts, providing more of a challenge for readers without being too challenging. SMOG rates these articles at 18, which I think, once again is inflated. The terminology reasoning previously discussed is apt here, as well. I do, however, think that, math level aside, this text, even if used with 10th graders, is more focused toward those students with a more advanced reading comprehension – say, the comprehension of a 12th grader, because it does use more advanced terminology in addition to the familiar poly-syllabics.

(Flesch-Kincaid level: 12.0)
SMOG level: 18

6. Berlinghoff, William P., and Fernando Q. Gouvêa. "Measuring the Circle: The Story of Pi" in <u>Math through the Ages</u>. (pp. 107 – 112) 1st ed. Oxton House Publishers and The Mathematical Association of America, Inc., 2004.

This chapter of *Math through the Ages* is in direct contrast with the previous text. "Measuring the Circle: The Story of Pi" is short and easily understandable. It starts out by providing the reader with a clue for pronunciation – "like the dessert or pizza." It guides the reader into the concept of pi, asking questions along the way and answering them. It delves into a timeline of the history, providing concise, intelligible details at each point. It provides examples of uses, and examines historical approximations for their accuracy. The chapter considers the allure of calculating digits of pi, and provides a brief explanation into the attraction pi has before providing further text references for interested readers as well as questions / problems for the reader to complete. Some of these involve more basic algebra skills; others, the historical aspects; still others, series and binary representations. This makes the chapter accessible at different levels of math. The chapter concludes with suggested

projects related to pi that require the reader to delve deeper and think about pi and related topics.

Flesch-Kincaid suggests 8.1, with which I would largely agree. The text is designed throughout the entire book to be accessible reading for most learners, and to nonetheless challenge them mathematically. This is an excellent text for secondary students who struggle with reading; whether or not they excel at math, the chapter provides them with options and opportunities.

Flesch-Kincaid level: 8.1
(SMOG level: 9.28)

Children's Literature:
7. Neuschwander, Cindy, and Wayne Geehan, illus.. <u>Sir Cumference and the Dragon of Pi</u>. 1st ed. Watertown, MA: Charlesbridge Publishing, Inc., 1999.

Sir Cumference and the Dragon of Pi is a 32-page math adventure that follows Radius, Sir Cumference's son, as he attempts to solve a circle measure riddle in order to turn Sir Cumference back to human [he had been accidentally transformed into a dragon]. Radius enlists the help of Geo and Sym Metry, two carpenters, and two members of his family – his mother, Lady Di of Ameter, and his cousin, Lady Fingers. During this adventure, Radius discovers something about the relationship between the circumference of the circle and its diameter. It's an entertaining book that makes discovering math fun!

SMOG suggests level 8.2, with which I would agree, and which I find appropriate. Some of the students may need or appreciate an easier reading level that still is not completely basic. Others will appreciate the clever word play with the characters' names and activities. Most will appreciate the review of one of the ways to find pi; the way in which Radius discovers pi is an excellent launching point into the approximations of mathematicians of the past.

(Flesch-Kincaid level: 5.2)
SMOG level: 8.2

Articles:
8. Funk, Carole. "James Otto and the Pi Man: A Constructivist Tale." <u>Phi Delta Kappan</u> 85(2003): 212-214.

This 3-page article is from a Special Section on Mathematics Education in *Phi Delta Kappan*. As a result, the end portion of the article is about constructivist learning; this section would not be required for the students. The first 2.5 pages of the article relate the story of a fifth grader named James Otto, whose teacher, Mr. Pie, had the students in his class collect data from all over the place about the circumference and the diameter of circles. Through these means, the students learned about circumference and diameter on their own, and also as a class were able to discover the relationship between the two – that the circumference is about 3 times the diameter. The students were excited to learn and discover math on their own. This is a great article for students who like to learn by discovering, and students who like applications for math problems. Here, James Otto and his classmates started with applications and found a mathematical relationship as a consequence. This text also encourages students to take risks and see if they can find patterns and relationships on their own.

Flesch-Kincaid suggests level 9.2 for this text. I would agree with their assessment. The article is not too difficult for students to follow, but uses terminology in an appropriate and effective way. Moreso, it is written from the perspective of a student, making it relatable even for those students who don't like school or like math. It introduces students to a project before throwing brand-new terminology at them, as well.

Flesch-Kincaid level: 9.2
(SMOG level: 11.02)

9. O'Connor, J. J. and E. F. Robertson. "A History of Pi." <u>MacTutor: History of Mathematics Archive</u>. Aug 2001. School of Mathematics and Statistics, University of St. Andrews, Scotland. 11 Dec 2008 <http://www-history.mcs.st-andrews.ac.uk/HistTopics/Pi_through_the_ages.html>.

O'Connor and Robertson provide a website full of articles and biographies on the history of math. Within the article, any topic or mathematician from which / whom they have a page is directly linked, allowing the student to explore and learn more about what interests them. Their article gives brief details about approximations of pi throughout history, including the different methods and formulae used by various mathematicians. This includes work with geometry, trigonometry, and series. In addition, the article links to more detailed pages about the various topics. It concludes with open questions about pi that may intrigue and challenge the students to think more deeply about the number. In some places, the article seems a tad dry, but in other sections it's peppered with anecdotes that will amuse and capture the interest of students.

SMOG rates this article at 14.24, but once again, I think this is due to the familiar, ubiquitous, poly-syllabic terminology previously mentioned. Also contributing is the length of some sentences. I believe this text would be appropriate for students between 10th and 12th grade with reading levels closer to 12th grade or slightly beyond.

(Flesch-Kincaid level: 9.5)
SMOG level: 14.24

10. Team C0110195, Think Quest. "Welcome to Your Piece of the Pi," and following pages, at Your Piece of the Pi. Sep 2001. ThinkQuest and PiClient. 11 Dec 2008 <http://library.thinkquest.org/C0110195/main.html>.

The *Your Piece of the Pi* site is designed with interaction in mind. It provides ample information first, but also provides the opportunity to try out new software. Considering the information, the site has sections "What is Pi?," "History of Pi," "Uses of Pi," and "Fun with Pi" before its sections on PiClient and an accompanying forum for discussion. In these sections, the site strives to be easily understandable, engaging, and brief. In addition, the forum provides readers with the opportunity to view others' thoughts on the history, applications, and mathematics of pi, as well as trigonometry.

Flesch-Kincaid suggests level 6.9 for the site, which is near what my expectations were for the site. I admit I thought it would be a little bit higher, but there is some variability with text selection, and as I said, the site authors attempt to be brief *and* understandable to readers. This text would be good for students who do not enjoy reading "heavy" material, but still wish to be involved with and informed of multiple aspects of pi.

Flesch-Kincaid level: 6.9
(SMOG level: 11.9)

As you can see, the readability suggestions from Flesch-Kincaid ranged from 5.2 to 12; the SMOG suggestions, from 8.2 to 18. Taking into account the polysyllabic terminology that inevitably frequents texts about pi, the suggestions end up providing appropriate materials for a diverse mixture of secondary students in geometry, trigonometry, or even pre-calculus. This text set also provides a variety of options for learning about various aspects of the number pi.