

## E-MATHEMATICA: MATH MILLENNIAL LEARNER'S PREFERENCES

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### Abstract

This paper presents the millennial generation's learning preferences in mathematics courses, their attitudes, and academic performance using digital and technologically enhanced learning processes. The objective of this study is to determine the learning preference of millennial college students in their mathematics classes. This study used qualitative and quantitative methods of research that involved 72 college students taking up mathematics courses. The results show that mathematics students learned with the 5 R's for millennial learning styles this includes research-based learning (RBL), relevance learning (ReL), rationalized learning (RaL), relaxed learning environment (RLE), and rapport-oriented learning environment (ROLE). In general, these millennial learners preferred to learn with fun and are dependent on the technology available today they call it e- mathematics. The e- Mathematica learning style is recommended in teaching mathematics courses.

**Keywords:** E- Mathematics, Millennial Learners, E- Mathematics, Math Learning Preference, 5 R's Learning Style.

### 1. INTRODUCTION

The Millennial generation is the most computer-literate generation (Lancaster & Stillman, 2002). Also known as the Net Generation those have been raised in an era of instant access (Coomes & DeBard, 2004; Lancaster & Stillman, 2002). . Their learning and communication style is through multi-media, and their form of communication is text messaging, instant messaging as well as cell phones. Learning has even moved into web-based tools such as the web, online courses, online journals, and downloads The attitudes of Millennial generation students in college were measured regarding the style of learning they use, prefer and which method has resulted most successfully in their acquiring and retaining knowledge.

The teacher who stood in front of a classroom of Millennial, or any students, has been concerned with if and how his or her students is learning the material (Marías, 1970; Smith & Clurman, 1997). . There may even be a question if the student is truly taking notes on the shielded, black box that sits on his or her desk or simply checking on the plans among friends for the evening's activities.

Millennial learners have a more global orientation and understand the need for interconnectivity in the worldwide market (Alch, 2000). Millennials are part of a generation that merely depends on technology (Pelton & True, 2004). That has experienced real-time games and reality television MTV, (music television), which has been around all of their lives (Coomes & DeBard, 2004). According to generational consultant and researcher Cam Marston (2005), the Millennials “feel entitled to life's rewards without paying their dues” and they have

had less free time than any other generation (Howe & Strauss, 2000). They are said to have strict parents (the over-involved Boomer parent) (Sacks, 2006). The Millennial has been described as techno-literate, techno-savvy, technologically fluent, and even dependent on technology (Lewis, 2003; McGhee, 2006; Zemke, Raines, & Filipczak, 2000). In a nationwide survey of 1,171 college students, 97% of these Millennials owned cell phones and over two-thirds had sent text messages on them. Over half of the students in the study said that “instant messaging was their top choice of communication” (McCasland, 2005, p.8). They download podcasts and music, can take photos with their phones, and text message one another in their created messaging language (McCasland, 2005). Millennials are said to be experiential, engaging, and interactive (Skiba, 2006).

Millennials have a “curious blend of collaboration, interdependence, and networking to achieve their ends” (Alch, 2000 p. 4) and their technology seems to bring them and keep them together. Instant messaging, text messaging, and chat rooms may be essential to urban and suburban millennial connectivity (Cox, 2004). Their style is high-tech and highly networked and Millennials “will want to be able to work quickly and creatively, and they want to do it their way” (Zemke, Raines, & Filipczak, 2000, p. 143). Their creativity and investigation of electronic media, free expression, strong views, and the need for independence without restraint are noted facets of their generation (Alch, 2000).

Millennials’ most widely used cell phones and text messaging (McCasland, 2005). The experiences of connectivity through text messaging, instant messaging, blogging, and video gaming, socializing through technology such as Camera phones, e-mail, instant messaging, and chat rooms, many ‘buddies’ on their ‘buddy list’ (chat mail contacts) have never been met in person (Cox, 2004). Millennials are accustomed to relating and collaborating with others through technology. They like teamwork, but they prefer to collaborate and work in teams with their generational peers (Lancaster & Stillman, 2000; Skiba, 2006). Also described as self-reliant and independent, Millennials are known for their ability to create with technology (Marston, 2005; Martin, 2005). Millennials communicate via technology (Murray, 2004, p. 106). Considering the characteristics of the millennial generation, there is some concern about the effects on their learning process. “Many young people today are accustomed to watching TV, talking on the phone, doing homework, eating, and interacting with their parents all at the same time” (Frاند, 2000). Routine multitasking behavior may have shortened their attention span and caused them to lack critical thinking skills and introspection (Murray, 1997). Although there may be a concern for Millennials’ analysis of the material, there is confidence in their usage of media that can be a tool for learning. Constance Yowell, MacArthur Foundation’s director for digital media, learning, and education, noted that digital technology, “a peer-driven learning” is very familiar to this generational cohort as “young people are way ahead of the adults in understanding how to use these tools” (Trei, 2006, p.2). Yowell asks “in 10 to 15 years, will kids coming into public education be thinking, behaving or acting differently, or expecting different things because they’ve been engaged in digital media?” (Trei, 2006, p.1). According to the foundation’s statistics, they will be, as nearly seventy-five percent of young people use instant messaging and eighty-three percent play video games (Trei, 2006) – a certain indication of changed attitudes towards learning and interaction.

## 2. METHODOLOGY

This paper will address the questions regarding the learning preferences of the Millennials. What are Millennials' preferences for learning methods? Which teaching format is preferred? How do they try to improve their learning? Students in mathematics courses were invited to participate in a survey. Approximately 72 students take part in the survey. Of the survey response of the 72 surveys returned, 72 were Millennials and used for this study. The response rate was less for some items that were skipped/missed but all surveys used included the demographic data of the respondents. The survey instrument included some items adapted from a previous study by Messineo, Gaither, Bott & Ritchey (2007) that focused on college students' preferences for learning class material, specifically for active learning in large classes. Additional created items included locations of studying and attitudes toward Service Learning work that is not a part of this paper.

Although large enough to make generalizations about attitudes, the sample size of Millennials may reflect a distinguishable attitude of state universities. The sample also only included those Millennials in the advanced stages of education, an opportunity not available for all Millennials. Within this cohort, there are still some "have-nots" regarding access to technology (Brownstein 2000). The study also only reached those with Internet access. Web-based surveys may not get responses from those who are not comfortable with technology (Shannon, Johnson, Searcy & Lott, 2002). It should also be noted

## 3. RESULTS

Of the 72 respondents, 44 were female and 28 were male. This disparity is not surprising considering the demographics of the school; only about 39% of students are male.

In response to the question "What study methods help you to better understand a course topic?" students show that listening to recorded lectures dominates among strongly agreed study methods, adding notes in class to printed PowerPoint slides was agreed by the majority, typing notes in a class in power points disagreed and reading materials before class is strongly disagreed.

**Table 1: Study methods of the millennials math Learners**

What study methods help you to better understand a course topic?				
	Strongly agree	Agree	Disagree	Strongly disagree
Typing notes in class	15 (20.83%)	20 (27.78%)	<b>26(36.11%)</b>	11(15.28%)
Adding notes in class to printed PowerPoint slides	20 (27.78%)	<b>25(34.72%)</b>	19(26.39%)	8(11.11%)
Typing notes in class on PowerPoint slides	18(25.00%)	18(25.00%)	25(34.72%)	11(15.28%)
Reading the material before class	10(13.89%)	20(27.78%)	8(11.11%)	<b>34(47.22%)</b>
Reading the material after class	15(20.83%)	16(22.22%)	22(30.56%)	19(26.39%)
Listening to recorded lectures	<b>25(34.72%)</b>	18(25.00%)	15(20.83%)	14(19.44%)

In response to the question "What types of electronic resources do you use for your assignments?" google was rated as frequently used, e-journals, websites, blogs/wikis,

Wikipedia, and you tubes were rated as seldom used and e-books and emails rated as don't use.

**Table 2: Preferred Electronic resources of millennial students**

What types of electronic resources do you USE for your assignments?						
	Strongly agree	Agree	Disagree	Strongly disagree	Mean	Remarks
E-books	10	20	22	20	2.28	Don't use
E-journals	19	12	33	8	2.58	Seldom
E-mails	12	21	29	10	2.49	Don't use
Web sites (yahoo groups)	19	42	10	1	3.10	Seldom
Blogs/wikis	18	17	28	9	2.61	Seldom
<b>Google</b>	<b>65</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3.82</b>	Frequently
Wikipedia	27	23	16	6	2.99	Seldom
Social web ( Youtube)	15	20	30	7	2.60	Seldom

The mean of 4.92 was noted for “always used” Facebook, YouTube (4.49), and Wikipedia (3.94) were noted as most often used and Myspace, online library, and other sources were noted as sometimes used. An additional item reiterated the preferences of Google and “other” search engines over library resources when asked how an information search was started.

**Table: 3**

What types of electronic resources do you USE for your assignments?							
	Always	Most often	Sometimes	Rarely	Never	Mean	Remarks
Online Library	<b>15</b>	18	19	15	5	3.32	sometimes
Google	24	22	16	4	6	3.75	most often
Wikipedia	28	21	16	5	2	3.94	most often
Social web applications	15	25	23	8	1	3.63	most often
<b>Facebooks</b>	<b>69</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>4.92</b>	<b>Always</b>
Myspace	11	9	12	29	11	2.72	sometimes
Youtube	45	19	6	2	0	4.49	most often
Other sources	24	12	13	17	6	3.43	sometimes

Google was again the most used starting point followed by “other.” As Wikipedia was not included.

For the item regarding preferences of learning course material, the majority of the 72 respondents strongly agreed (42.9%) and agreed (42.9%) with preferring PowerPoint slides along with lectures. Collapsing strongly agree and agree categories and strongly disagree and disagree categories, other learning method results were:

- a) I learn from video clips that relate to class material. (86.8% agreed, 13.2% disagreed)
- b) I like a mixture of activities using Technologies in a large class (**91.3% agreed**, 8.7% disagreed)
- c) Having to solve problems in class helps me learn the course material using math application software (**92.3% agreed**, 6.8% disagreed)

- d) I prefer lecture as the format of class instruction (47.3 % agreed, 62.6 % disagreed)
- e) I consider the class discussion in small groups with other students to be a valuable way to learn the course material using online chat groups/ technologies.(63.6% agreed, 16.4% disagreed)
- f) I think doing group work in class is a valuable way to learn material such as game-based solving. (72.3% agreed, 27.8% disagreed)
- g) I think frequent quizzes over the reading or assignments are a good idea in a form of games (80.2% agreed, 19.8% disagreed).

Interestingly, solving problems in class, a mixture of course material, and preferring frequent exams with a variety of ways to earn grades ranked in the 90<sup>th</sup> percentile. Although the lowest ranking (62.6%) of the items was for the lecture the format of class instructions was still agreed upon by the other respondents. Having to solve problems in class helps me learn the course material using math application software (92.3%) was a majority as highly ranked as others.

How important methods of study were perceived to improve their learning of course material was asked by the following item in Table 4 below

**Table 4: Important methods of study were perceived to improve their learning of course material**

Importance of the effectiveness for improving knowledge of course material						Remarks
	Very Important	Important	Somewhat Important	Unimportant	Mean	
Dyad	5	10	18	39	1.74	Somewhat Important
Peer tutoring	18	14	19	21	2.40	Somewhat Important
<b>Minute paper</b>	<b>9</b>	<b>19</b>	<b>12</b>	<b>32</b>	<b>2.07</b>	<b>Somewhat Important</b>
<b>Lectures</b>	<b>3</b>	<b>20</b>	<b>23</b>	<b>26</b>	<b>2.00</b>	<b>Somewhat Important</b>
<b>Discussion</b>	<b>10</b>	<b>14</b>	<b>16</b>	<b>32</b>	<b>2.03</b>	<b>Somewhat Important</b>
<b>Game-based Learning</b>	<b>20</b>	<b>26</b>	<b>18</b>	<b>8</b>	<b>2.81</b>	<b>Important</b>
Take home Test	5	14	18	35	1.85	Somewhat Important
Web group discussion	10	25	21	16	2.40	Somewhat Important
<b>Online chat</b>	<b>15</b>	<b>24</b>	<b>21</b>	<b>12</b>	<b>2.58</b>	<b>Important</b>
<b>Online based learning</b>	<b>25</b>	<b>22</b>	<b>15</b>	<b>10</b>	<b>2.86</b>	<b>Important</b>
Team-Based Solving	16	18	20	18	2.44	Somewhat Important
Problem-based Learning	16	20	18	18	2.47	Somewhat Important

Online-based learning (2.86), game-based Learning (2.81), and online chat (2.58) were rated as important others were rated as somewhat important however, lectures, Discussion, and

Minute paper methods were rated as the lowest among the rest. This could be the result of the efforts of the student using the material and/or the design and method of the material itself.

The students learn with the 5 R's for millennial learning styles, Techno-literacy is the preference of the millennial students in learning mathematics they preferred rapport oriented learning environment ( 3.33) wherein they like instructors showing personal interest in their most preferred learning styles and easy to be with, they hate terror teachers; Relax learning environment ( 3.13 ) which is usually fun; research-based learning ( 2.96); Rationalized learning ( 2.86), wherein less authoritative environment teaching environment; and entertaining; and relevance learning( 2.69) which are ace at "searching " and discovering information.

**Table: 5**

5 R's	Most Preferred	Preferred	Less preferred	Not preferred	Mean	Remarks
Research-based Learning	25	28	10	9	2.96	Preferred
Relevance Learning	20	20	22	10	2.69	Preferred
Rationalized Learning	21	30	11	10	2.86	Preferred
Relax Learning Environment	29	28	10	5	3.13	Preferred
Rapport-Oriented Learning Environment	40	21	6	5	3.33	Preferred

#### 4. CONCLUSIONS

The results of this study indicate the many uses of technology, such as typing notes in class and searching online, of Millennials. It is still interesting to note that in a school where laptops are required of students, it is a small percentage that brings them to class for typing notes. This could be due to the burden of carrying a computer to class or the typing skill of the user. As for research, the low percentage of scholarly research sites is a concern. In the 2007 study, millennial students used Google frequently and thought Google a more useful tool than those provided by the library and frequently used Wikipedia for assignments. (Nicholas & Lewis).

Mathematics students learn with the 5 R's for millennial learning styles, they most prefer to use technologies in learning and easily get bored with the traditional way of teaching mathematics. Techno-literacy is the preference of millennial students in learning mathematics they preferred research-based learning, relevant learning which are ace at "searching " and discovering information; Rationalized learning, wherein less authoritative environment teaching environment; Relax learning environment which is usually entertaining; rapport-oriented learning environment wherein they like instructors showing personal interest on their most preferred learning styles and easy to be with, they hate terror teachers.

Learning methods will have to continually adapt to engage and educate this generation. Their interest in multimedia is shown by their answer to favoring PowerPoint in classes. But does that just add entertainment and prevent discussion or problem-solving? There was an indication that these respondents value group work, problem-solving, and case analysis. But does the

preference for more testing indicate short-term memory and not retaining the knowledge for future needs and analysis?

## 5. RECOMMENDATIONS

There are several opportunities for future research about this generation and their learning preferences. Certainly, a larger sample could be used, and yearly comparisons could yield more information. An assessment of learning could be measured. Comparison with other generations and faculty attitudes as well as the personality of the participants and gender differences could be discerned.

This kind of learning should be investigated. Websites may become more popular with learning methods. Just as E-learning has shown cost savings for workplaces (Macpherson, 2004), educational institutions may recognize a benefit both financially and in student learning through new technological methods. Educators and managers will have to adapt to new means of engagement to attract and retain the Millennial students and workforce.

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