Teaching Financial Literacy Using Game-Based Instruction:
A Summary of Initial Research on MoneyU®

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Executive Summary

Four studies show that MoneyU's game-based instruction leads to significant learning, even for students who have had some prior financial training. Across the studies, **while only 20% of the students passed the pretest, after taking the MoneyU course, 98% passed the posttest**. The results were very consistent across the four studies in high school and college classes, despite different teachers, curriculums and demographics. The data from these studies indicate that the differences in pretest and posttest scores were significant, and the effect sizes can be described as very large.

Total Sample Results

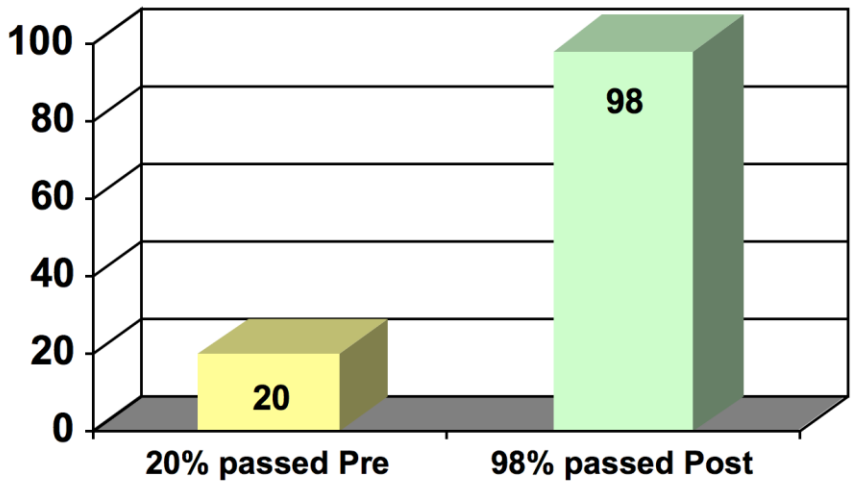

Figure 1

	Mean	SD	% Passing	N
Pre	54.1	14.0	20%	187
Post	73.8	6.3	98%	187

t	Significance	Effect Size
-19.7	p < .0001	1.8

Pre-Post Test AAC Community College

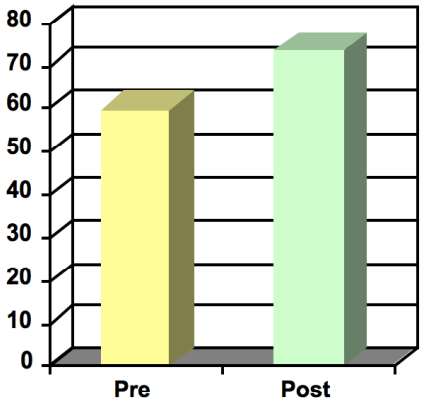

Figure 2:

- **N = 35** college students
- Mean number of days to completion = **8.11 days** (SD = 5.8)
- Pre Post mean scores differed significantly **t = 7.01** (p < .0001)

	Mean	SD	Effect Size
Pre	59.9	14.4	
Post	73.7	7.7	1.2

Pre-Post Test CZM High School

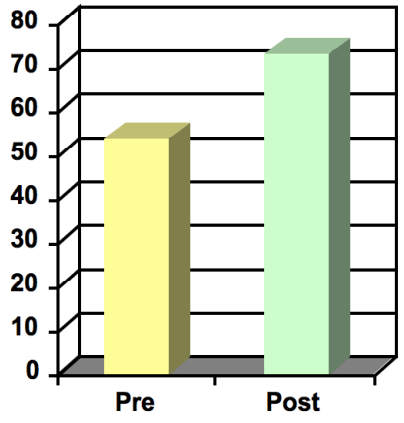

Figure 3

- **N = 19** HS Seniors
- Mean number of days to completion = **18.8 days** (SD = 6.9)
- Pre Post mean scores differed significantly **t = 5.75** (p < .0001)

	Mean	SD	Effect Size
Pre	53.7	16.6	
Post	73.4	5.6	1.6

Pre-Post Test MBM High School

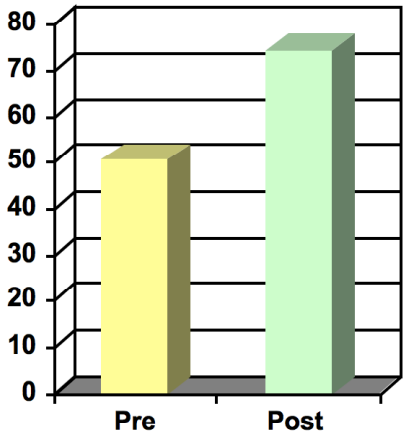

Figure 4:

- **N = 60** HS Seniors/Juniors
- Mean number of days to completion = **22.2 days** (SD = 3.8)
- Pre Post mean scores differed significantly **t = 16.9** (p < .0001)

	Mean	SD	Effect Size
Pre	50.5	10.8	
Post	74.4	6.2	2.7

Pre-Post Test WCC High School

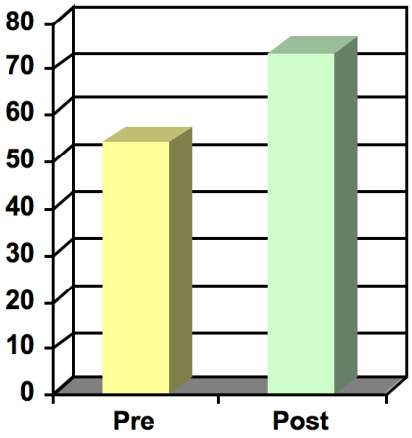

Figure 5

- **N = 73** HS Seniors/Juniors
- Mean number of days to completion = **17.7 days** (SD = 5.0)
- Pre Post mean scores differed significantly **t = 10.69** (p < .0001)

	Mean	SD	Effect Size
Pre	54.2	14.7	
Post	73.5	5.9	1.7

Background

The Crisis of Financial Illiteracy

Financial literacy statistics increasingly indicate that parents and educators are failing to teach responsible personal finance skills across broad spectra of age, race, and income level. All Americans, even the financially capable, suffer the economic consequences of continued failure to educate young adults about the advantages and disadvantages of their financial decisions. The consequences include lending constriction, asset erosion, and national recession. The sub-prime mortgage debacle is merely the most recent evidence of the scope of the problem.

This national crisis has been growing exponentially the last 10 years, and has had legislators, educators, and the financial industry scrambling to provide financial training that is effective and scalable. Young adults are the prime target for such training, because in young adulthood they are beginning to make independent financial decisions and mistakes, sometimes grave mistakes with lasting consequences. One of the fastest-growing segments of bankruptcies is age 18 to 25.[1] Seven States in the last few years have mandated personal finance as a requirement for high school graduation[2]; more are expected to follow suit. Colleges nationwide are revamping their orientation programs because so many students drop out due to financial difficulties. But despite the steady crescendo of public outcry about financial illiteracy, students have overwhelmingly failed the annual Jump$tart National Financial Literacy Survey, every year since its inception in 1997.[3] Clearly, efforts to date have been insufficient.

Problems with Traditional Instruction

Many parents don't know how to teach personal finance, because they are struggling with it themselves. School systems generally do not have the time or staff to commit to non-core, non-academic subjects. Books are time-consuming. Lectures are often unengaging, and their effectiveness varies enormously according to the skills and knowledge of the teacher. Materials developed and offered by financial institutions are often perceived as being biased because of what content is and is not included.

Moreover, Digital Natives[4] present new challenges for traditional instructional methods. Digital Natives expect to be entertained and constantly engaged.[5] They prefer active, self-directed learning, which gives them continuous feedback. They have little patience for the passive experience of sage-on-the-stage lectures. They appreciate online content for its accessibility, and time-compressed convenience. They like games.

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[1] *The Fragile Middle Class: Americans in Debt*; Elizabeth Warren, Harvard Law School, 2001.

[2] Survey of the States: Economic and Personal Finance Education in Our Nation's Schools in 2007. National Council on Economic Education

[3] Jump$tart Coalition for Financial Literacy, 2006 JumpStart Executive Summary

[4] A term coined by Marc Prensky, in his book "Engage Me or Enrage Me", as it pertains to a new breed of student entering educational establishments. A digital native is a person who has grown up with digital technology such as computers, the Internet, mobile phones and MP3. http://en.wikipedia.org/wiki/Digital_native

[5] Digital Game-based Learning: It's not just the Digital Natives Who are Restless. Richard Van Eck, 2006. EDUCAUSE Review, vol 41, no2.

New Approaches

Financial literacy is not limited to financial knowledge, but includes *skills* and *behaviors* that must be rehearsed and habituated. To become financially competent, learners must experiment with different inputs and conditions in order to truly understand the financial consequences of their choices.

Clearly, many different kinds of solutions must be brought to bear on the problem of financial illiteracy, particularly solutions that are scalable, engaging, cost-effective, and efficacious. eLearning, with simulations and games, allows engaging, learner-driven experimentation in a safe and entertaining environment. Web-based, pedagogically-sound simulations can deliver skills practice to thousands at a time (not a classroom at a time) at accessible per-head costs. Excellent computer-based instruction is expensive to create, prohibiting individual school systems or even individual States from undertaking development. MoneyU is a breakthrough solution that leverages the scalability, built-in assessment, and cost-effectiveness of elearning with the engagement and skills practice of games.

The Course

MoneyU is a web-based course in personal finance designed especially for young adults. The instructional design offers learner-centric, learner-paced, standards-based curriculum that teaches both financial knowledge and skills practice. Learners can complete the course in as many sittings as desired. All learners in the studies completed the course in under 22 days, many in as few as 8 days. Over the course of a semester, this translates to under 15 minutes a day.

MoneyU can be implemented in a variety of ways: as a supplement in an existing teacher-led course, as a peer-led group activity, or as the core material for a learning community, that can fit into a semester or an intensive weekend workshop. The curriculum is delivered in brief, game-based multimedia lessons that include guided experiments, interactive tasks, simulations, and formative quizzes, supported by a substantive, context-driven Reference. A Learning Management System tracks completed lessons and test scores, by which one administrator can shepherd hundreds of learners through the course.

The Curriculum

The content covers 120 lessons across 8 Topics that map to the standards of 15 States' curricula[6] in Personal Finance and Consumer Science:

Wise Credit Card Use	Smart Savings
Wise Spending	High Credit Score
Good Debt	Good Planning
Good Banking	Smart Earning

Each multimedia lesson uses widgets and simulations to present progressively complex concepts and rehearse progressively complex tasks (e.g., first comparing different credit card offers, and then examining cardholder agreements for penalty fees). Each lesson also uses formative Question-Based Learning, with feedback, to ensure the learner has mastered the concept or task before moving on to the next lesson[7].

The Pretests and Posttests

The pretest is comprised of 50 questions presented in random order with items that map to the content. The pretest must be completed before the learner has any access to the content or instruction. Each question is presented one-at-a-time, with no way to preview other questions, or to revise answers to previous questions. To avoid question fatigue, learners can complete the pretest in as many sittings as desired. The posttest was comprised of the same randomized 50 questions, and in the same, one-at-a-time, no-preview, no-revision presentation.

6 Florida, Georgia, Illinois, Indiana, McRel (a consortium including Iowa, Minnesota, Nebraska, North Dakota, and South Dakota), New Jersey, New York, North Carolina, Pennsylvania, and Jump$tart (a National Coalition for Financial Literacy).

7 For content detail, see "Curriculum" Attachment. Students can access the lessons either in Topic mode or Milestones mode; and can toggle between the two modes if desired. The lessons are identical, regardless of mode or lesson order.

Four Studies

MoneyU was beta-tested in the spring of 2007 in nine high school classes at three schools, and four college classes at one college. Students took a 50 item pretest, then the course, then a posttest of the same questions, with the questions and the response items both randomized. The differences between the pretest and the posttest scores were used to measure students' learning from the course.

In addition, students were invited after the Posttest to post their reactions and opinions about their experience with MoneyU. Their remarks are compiled in "What our MoneyU testers told us", attached.

The beta test data includes 187 students who completed the course and the posttest. All the students in every study had had at least one semester in a financial class before taking MoneyU. It might be speculated that their previous financial instruction may have improved their pretest scores somewhat, compared to a general population with no prior exposure to financial content. Although demographic data for individual students were not obtained, a description of the participating schools follows.

In summary, the beta test site schools had diverse populations and all of the students had background knowledge from previous classes in financial subjects.

AAC Community College

AAC is a 2-year college, nationally recognized in 2007 as a Top Digital Community College, for its progressive and effective incorporation of eLearning into the curricula. AAC has a fulltime enrollment of 9,000 students, and a total credit enrollment of 22,000. The school's web site describes its enrollees as 64% white, 14% African American and 22% "diverse".

The 35 AAC students were enrolled in a second semester "Principles of Accounting" course. Many of these students had an additional semester or more of Accounting or Finance, before accessing the MoneyU pretest and course. These students accessed the course on their own time with instructions to complete the course and posttest by the end of the semester. Completing the course was a small component in the computation of their final grade, regardless of their posttest score. The students emailed questions to the instructor. Most students finished the course in 8 days, suggesting that they were motivated and engaged by the course.

CZM High School

CZM high school is a large, suburban/ rural high school of over 2000 students: 46% white, 20% African-American, 19% Hispanic , and 15% Asian. The 19 students in the sample were all seniors enrolled in an Economics course within CZM's Academy of Finance® program. Before taking the MoneyU pretest and course, nearly all of them had also taken one semester of Personal Finance, and most of them had one or two semesters of finance-related courses in their junior year.

These students accessed MoneyU synchronously; that is, over a period of several weeks, the students met in a computer lab two times a week and accessed an assigned sequence of MoneyU lessons there

and at home. All these students completed the course in 19 days; the number of days the class met. Interestingly, students at this school *created their own competition for the highest Net Worth* by the end of the course.

MBM High School

MBM is a very large urban high school, located just outside the District of Columbia. It is a Magnet School for Science, Technology, and Entrepreneurship. MBM has a very diversified enrollment of about 3,000 students, with 25% White, 31% African American, 27% Hispanic and 17% Asian.

The 60 students in this study were juniors and seniors enrolled in MBM's Academy of Finance® program, and had taken at least one semester of Personal Finance before accessing the MoneyU pretest and course. Students took the class synchronously twice a week; their posttest score contributed to their final grade. Nearly all students completed the course in 22 days,the number of days the class convened.

WCC High School

WCC is a large, suburban, high school for approximately 2,200 students in a state that mandates Consumer Science as a high school graduation requirement. Its enrollment demographics are: 48.7% White, 41.6% Hispanic, 3% Asian, 2.3% African-American, 0.2% Native-American, and 3.3% "Multi". Students who took MoneyU at this school had received the required one-semester course in Consumer Science before taking the MoneyU pretest or accessing the course. WCC administered the course synchronously, using it as the culminating course review. The students' posttest scores were a substantial percentage of their final grade in the mandatory course.

Analysis Methods

Percentages, means, standard deviations, effect sizes and t-tests were completed for each class and for the entire sample. Effect size is the difference in mean scores expressed in standard deviation units. Effect size was calculated using the following formula:

Effect size = (posttest score - pretest score) / (weighted standard deviation)

The larger the difference between the posttest and pretest scores, the bigger the effect size will be. Generally, an effect size of .3 is considered small, .6 is in the medium range and greater than .8 is large.

T-tests were used to test the significance of the pretest and posttest mean score differences for each group and for the total sample. The significance of the statistic is expressed as a *p* value, which is the probability that the value would appear by chance due to random sampling fluctuation. In educational research, we look for the critical value of $p < .05$. In each case, the t-test results were significant at $p < .001$. We can conclude, therefore, that the differences between the pretest and posttest scores were attributable to the MoneyU course. The means, standard deviations, t-test results, and effect sizes are provided in Figures 2 through 5, and in Figure 1 for all students total in these four studies. These results consistently show that the differences between the pretest and posttest means were significant (all t-tests were significant) and the differences were substantial (all effect sizes were greater than .8).

Results

The means, standard deviations, t-test results, and effect sizes are provided in Figures 1 through 4 for each sample, and in Figure 5 for all students included in these four studies. In each case, the t-test results were significant at $p < .001$. We can conclude, therefore, that the differences between the pretest and posttest scores were attributable to the MoneyU course. These results consistently show that the differences between the pretest and posttest means were significant (all t-tests were significant) and the differences were substantial (all effect sizes were greater than .8).

Using all the beta test data, the t-value was 19.7 ($p < .001$). The degree of freedom for this t-distribution was 186. Usually, if the degrees of freedom exceed 120, the normal distribution is used as an adequate approximation for the t-distribution.[8] This indicates that the data was approximately a normal distribution. Using the entire sample, the effect size is a significantly large value of 1.8.

One final level of analysis was conducted based on a calculation of the number of students who would earn a passing or failing grade in the pretests and posttests. Passing was defined as earning 65% or more correct on the pretests and posttests. Using this criterion, only 20% of the students passed the pretest but 98% passed the posttest after completing the MoneyU course. This is particularly remarkable because all of the students in these samples had completed at least one course in a financial subject.

Conclusions

The results of these four individual studies and the findings for the four studies as a whole provide compelling evidence of the effectiveness of the game-based learning environment of MoneyU. The students made substantial improvements after participating in the course. Significant learning occurred with the MoneyU course as evidenced by 98% of students passing the posttest after only 20% of them passing the pretest, and the large effect sizes. The pretest means were consistent in all classes: ACC 59.9, CZM 50.5, MBM 50.5 and WCC 54.2. The posttest means were consistent in all classes: ACC 73.7, CZM 73.4, MBM 74.4 and WCC 73.5. The differences between the posttest and pretest scores were large as evidenced by effect size. Effect sizes were ACC 1.2, CZM 1.6, MBM 2.7 and WCC 1.7. An effect size greater than .8 is considered large.

[8] (Weirsma & Jurs, 2005)