

From Smileys to Smileycoins: Using a Cryptocurrency in Education: Open Review

Authors: Gunnar Stefansson,^{†*} Jamie Lentin[‡]

Reviewers: Reviewer A, Reviewer B

Abstract. The final version of the paper “From Smileys to Smileycoins: Using a Cryptocurrency in Education” can be found in Ledger Vol. 2 (2017) 38-54, DOI 10.5915/LEDGER.2017.103. There were two reviewers who responded, neither of whom have requested to waive their anonymity at present, and are thus listed as A and B. After initial review (1A), the author submitted a revised submission and responses (1B). The revised submission was reviewed once again by reviewers A and B, who determined that the author had adequately and substantively addressed their concerns, thus completing the peer-review process. Authors’ responses are bulleted for clarity.

1A. Review

Reviewer A:

Does this paper represent a novel contribution to cryptocurrency or blockchain scholarship?:

Yes

If you answered "yes" to the previous question, in one sentence, describe in your own words the novel contribution made by this paper:

The paper is an intriguing case study in the use of cryptocurrency in education

Is the research framed within its scholarly context and does the paper cite appropriate prior works?:

[†] G. Stefansson (gstefans@gmail.com) is a Professor of Statistics in the Mathematics Department at the University of Iceland.

[‡] J. Lentin (lentinj@shuttlethread.com) is the Director of the software consultancy Shuttle Thread Limited, based in the UK.

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Important references are missing

Please assess the article's level of academic rigor.:

Good (not excellent but a long way from poor)

Please assess the article's quality of presentation.:

Unsatisfactory (better than poor but a long way from excellent)

How does the quality of this paper compare to other papers in this field?:

Top 20%

Please provide your free-form review for the author in this section.:

Thanks for the opportunity to review this work! This is an interesting and novel case study of cryptocurrency in the education space that sits at the intersection of a number of disciplines. I believe it will serve as a foundational study for future research of cryptocurrency considerations in the education space. However, the article will need some further work around clarity and consistency, detailed below.

The article shifts in tone significantly about halfway through the article. The first half is a technical writeup of the details, which could benefit from clearer presentation around parameters of the coin, as well as the premine. The second half detailing the practical implementation and student reception of SMLY flows better. However, there are some threads of ideas that would benefit from being drawn across the two, such as addressing the importance of liquidity which is referenced in both sections. It is assumed that liquidity on exchanges helps to facilitate the increased fungibility of the currency for use by students, but this is not necessarily made explicit.

In the cryptocurrency section, there is some introduction to blockchain, but I think that some of these parts can be significantly shortened or removed altogether, given that those reading Ledger are familiar with basic concepts and also because the article jumps into Script, premining, etc. fairly quickly.

There is reference to the MIT Bitcoin project, but I think some of the details may need to be verified and clarified. The MIT Bitcoin project was not available to all students on campus and not everyone who was offered the opportunity necessarily enrolled. The project was presented to undergraduate students at a cost of ~\$500K USD. As well, the findings of the MIT Bitcoin project particularly around dynamics of early adopters are quite interesting and I'm surprised that there is no mention of this in your discussion / analysis.

Also, the section detailing the premine could benefit from a bit more clarity in the wording and a table or other visual aid may bring some clarity to it.

The section on the two bots is technically interesting, but it is not clear on why this is important. If this is connected to providing liquidity so that it is of more use to students trying to cash out, the connection needs to be made a bit more explicitly.

At various points, there are statements that are made with regards to decisions around SMLY implementation or things that happened, and it would be helpful to understand why. I.e. 0.6 bn allocation to liquidity providers, wallet developers; “complete havoc” after BTC prices rose in 2017.

On the smly.is - I noted that there is a section where you can play double or nothing. This is not in the scope of this paper, but this is fascinating as an option and I’m personally curious if students use this functionality!

If the data is available, I think that additional details around redemption of specific goods would further strengthen the article.

In the section regarding abuse - it is not clear what the “first” attack was— there seems to be a description of three cases and then a description of the second and third attacks. Also, there is no mention of 51% attacks, is this a potential threat that you’ve had to mitigate against if a giant pool starts mining?

There are a few minor wording and typos pieces that I have identified in the scanned version of my review. Arbitration vs. arbitrage, etc.

In the discussion, the reference to experiments regarding using fiat currency, paying students for grades would benefit from citations as there are numerous studies available and perhaps acknowledgement that these have mixed results. It may be helpful to also reference parallels to findings in the MIT Bitcoin project with regards to adoption.

The point about EIAS and providing new perspective is very interesting and provides an intriguing introduction to philanthropy to many of your students.

In the scanned version of my comments there are more details and questions inline - please refer to that for further questions/comments.

Overall, I think this will be a useful contribution to the cryptocurrency and education space

Reviewer B:

Does this paper represent a novel contribution to cryptocurrency or blockchain scholarship?:

Not sure

Is the research framed within its scholarly context and does the paper cite appropriate prior works?:

Irrelevant/spurious references are included

Please assess the article's level of academic rigor.:

Unsatisfactory (better than poor but a long way from excellent)

Please assess the article's quality of presentation.:

Unsatisfactory (better than poor but a long way from excellent)

How does the quality of this paper compare to other papers in this field?:

Bottom 50%

Please provide your free-form review for the author in this section.:

From smileys to Smileycoins - Using a cryptocurrency in education

1 Summary

The authors provide the detailed history of the implementation of a cryptocurrency (SMLY) in an educational platform to reward students' process of learning. The subjects of the study are undergraduate students of the University of Iceland of different cohorts. The authors change the amount of cryptocurrency rewarded over time to study its effectiveness.

2 Comments

2.1 General

The paper explores an interesting aspect of the educational discipline: that is, implements a reward like the cryptocurrency, whose value is defined by the secondary market. I read the paper carefully and, although I find this “experience” quite interesting, I regret to say that I do not see at the moment the real contribution that the authors want to give to the literature. The paper starts with a somewhat general introduction to the cryptocurrencies, then explain the use of SMLY in the educational system and then move to the results. The latter leaves me with many doubts, as it seems more an excursus of events rather than a proper intervention to prove the usefulness of the cryptocurrencies in the educational sector.

2.2 Major points

I find hard to understand the research question of the paper. In many experiments, in particular in economics, a parallel system of rewards (ECU or Experimental Currency Unit) is a standard way to explain incentives to subjects. Then, at the end of the experiment, ECU are converted into cash at a predefined exchange rate. Cryptocurrencies are not different in this respect from other way to incentivize.

- The authors used cryptocurrencies instead of valueless points to reward students' effort. Unfortunately nothing is reported about the effect of a financial incentives on students' performance. If the authors want to convince the reader that this is a good practice they should at least explain the positive externalities, if any.

SMLY are proposed, like any other cryptocurrencies, as “funny money” with no intrinsic value. However later in the paper they also talk about an agreement with shops in campus to use SMLY as a payment method. Was the value predefined by the authors? If there is no intrinsic value then I guessed there was no way subjects they could buy coffee with them. If, otherwise, the market value was implemented, then it would have been useful to state what was it and how students could spend them. If, there was a fixed exchange rate in campus, then we could not talk about “funny money” anymore.

It is highlighted the vary little use of SMLY by subjects. This seemed to be due to the very low value. What is the effect of this little incentive on performance? Is it possible to explore students motivations? There is an interesting bulk of the literature showing how wrong incentives crowd-out motivation (see e.g. Gneezy and Rustichini, 2000, ‘Pay enough or don't pay at all’).

Any statement about the use of coins is not supported by statistical tests.

2.3 Minor points

I have noticed many links to Wikipedia pages. As they could change and control over these may not be excellent, I suggest them to use different references.

2A. Authors' Responses

Reviewer A:

Does this paper represent a novel contribution to cryptocurrency or blockchain scholarship?:

- Yes
- No response needed.

If you answered "yes" to the previous question, in one sentence, describe in your own words the novel contribution made by this paper:

The paper is an intriguing case study in the use of cryptocurrency in education

- No response needed.

Is the research framed within its scholarly context and does the paper cite appropriate prior

works?:

Important references are missing

- Several more references have been added.

Please assess the article's level of academic rigor.:

Good (not excellent but a long way from poor)

- The overall rewrite of the paper has hopefully resulted in an improvement from this general score/comment

Please assess the article's quality of presentation.:

Unsatisfactory (better than poor but a long way from excellent)

- The overall rewrite of the paper has hopefully resulted in an improvement from this general score/comment

How does the quality of this paper compare to other papers in this field?:

Top 20%

- No response needed.

Please provide your free-form review for the author in this section.:

Thanks for the opportunity to review this work! This is an interesting and novel case study of cryptocurrency in the education space that sits at the intersection of a number of disciplines. I believe it will serve as a foundational study for future research of cryptocurrency considerations in the education space.

- No response needed.

However, the article will need some further work around clarity and consistency, detailed below.

- See responses to each comment separately.

The article shifts in tone significantly about halfway through the article. The first half is a technical writeup of the details, which could benefit from clearer presentation around parameters of the coin, as well as the premine.

- We have tried to rewrite this, including inserting a table to describe the SMLY timeline.

The second half detailing the practical implementation and student reception of SMLY flows better.

- No response needed.

However, there are some threads of ideas that would benefit from being drawn across the two, such as addressing the importance of liquidity which is referenced in both sections. It is assumed that liquidity on exchanges helps to facilitate the increased fungibility of the currency for use by students, but this is not necessarily made explicit.

- The initial reason for needing the liquidity bots was missing but is now described in the text (originally due to requirements from an exchange).

In the cryptocurrency section, there is some introduction to blockchain, but I think that some of these parts can be significantly shortened or removed altogether, given that those reading Ledger are familiar with basic concepts and also because the article jumps into Scrypt, premining, etc. fairly quickly.

- We have cut this down quite drastically. If the editor permits, we would *really* like to keep a little bit of an introduction to blockchains and cryptocurrencies. If this paper gets published, for most users of SMLY it is likely to become their main introduction to electronic currencies and this literally includes thousand of students.

There is reference to the MIT Bitcoin project, but I think some of the details may need to be verified and clarified. The MIT Bitcoin project was not available to all students on campus and not everyone who was offered the opportunity necessarily enrolled. The project was presented to undergraduate students at a cost of ~\$500K USD. As well, the findings of the MIT Bitcoin project particularly around dynamics of early adopters are quite interesting and I'm surprised that there is no mention of this in your discussion / analysis.

- We thank the reviewer for this correction. The text has been modified in more than one place to take this comment into account.

Also, the section detailing the premine could benefit from a bit more clarity in the wording and a table or other visual aid may bring some clarity to it.

- A table has been inserted.

The section on the two bots is technically interesting, but it is not clear on why this is important. If this is connected to providing liquidity so that it is of more use to students trying to cash out, the connection needs to be made a bit more explicitly.

- An explanation has been included.

At various points, there are statements that are made with regards to decisions around SMLY implementation or things that happened, and it would be helpful to understand why. I.e. 0.6 bn

allocation to liquidity providers, wallet developers; “complete havoc” after BTC prices rose in 2017.

- This has now been made more clear, by including more explicit detail on the “why” in each case.

On the smly.is - I noted that there is a section where you can play double or nothing. This is not in the scope of this paper, but this is fascinating as an option and I’m personally curious if students use this functionality!

- Alas we have not been able to obtain data from novaexchange.com who run this game. There is considerable negative discussion on betting games in Iceland due to gamers' addiction issues and therefore this option has never been advertised to students (except as a single comment on the web page). A paragraph has now been included on this topic.

If the data is available, I think that additional details around redemption of specific goods would further strengthen the article.

- More detail has been added, but taking this further will likely be pure speculation.

In the section regarding abuse - it is not clear what the “first” attack was— there seems to be a description of three cases and then a description of the second and third attacks.

- This has now been clarified. Also, a new and more interesting wave of attacks occurred after the first submission of the paper, leading to more elaborate methods of dealing with self-registration. This is now included in the paper.

Also, there is no mention of 51% attacks, is this a potential threat that you’ve had to mitigate against if a giant pool starts mining?

- A paragraph has been added describing an event which was probably a 51% attack.

There are a few minor wording and typos pieces that I have identified in the scanned version of my review. Arbitration vs. arbitrage, etc.

- These were extremely useful and should now all have been taken into account.

In the discussion, the reference to experiments regarding using fiat currency, paying students for grades would benefit from citations as there are numerous studies available and perhaps acknowledgement that these have mixed results. It may be helpful to also reference parallels to findings in the MIT Bitcoin project with regards to adoption.

- Several references have now been added, in an effort to put things into better context and perspective.

The point about EIAS and providing new perspective is very interesting and provides an intriguing introduction to philanthropy to many of your students.

- No response needed.
- Comment: Yes, it really does. Their response was quite surprising.

Overall, I think this will be a useful contribution to the cryptocurrency and education space

- No response needed.
- Comment: Thank you!

Reviewer B:

Does this paper represent a novel contribution to cryptocurrency or blockchain scholarship?:

Not sure

- The overall rewrite of the paper has hopefully resulted in an improvement from this general score/comment

Is the research framed within its scholarly context and does the paper cite appropriate prior works?:

Irrelevant/spurious references are included

- We have gone carefully through the references and added several references based on the reviewers' comments. We would, however, like to maintain the distinction between a scientific citation (reference) and an informal pointer to further information (a footnote) as we think this will be useful to the general reader.

Please assess the article's level of academic rigor.:

Unsatisfactory (better than poor but a long way from excellent)

- The overall rewrite of the paper has hopefully resulted in an improvement from this general score/comment

Please assess the article's quality of presentation.:

Unsatisfactory (better than poor but a long way from excellent)

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How does the quality of this paper compare to other papers in this field?:

Bottom 50%

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Please provide your free-form review for the author in this section.:

From smileys to Smileycoins - Using a cryptocurrency in education

1 Summary

The authors provide the detailed history of the implementation of a cryptocurrency (SMLY) in an educational platform to reward students' process of learning. The subjects of the study are undergraduate students of the University of Iceland of different cohorts. The authors change the amount of cryptocurrency rewarded over time to study its effectiveness.

- No response needed.

2 Comments

2.1 General

The paper explores an interesting aspect of the educational discipline: that is, implements a reward like the cryptocurrency, whose value is defined by the secondary market. I read the paper carefully and, although I find this "experience" quite interesting, I regret to say that I do not see at the moment the real contribution that the authors want to give to the literature.

- We have tried to add
 - (1) actual numerical results from statistical analyses (which we initially deemed outside the scope of the paper, but stand corrected)
 - (2) better descriptions of "why" this was done
 - (3) and many more clarifying comments throughout

We hope this will suffice to alleviate this issue.

The paper starts with a somewhat general introduction to the cryptocurrencies, then explain the use of SMLY in the educational system and then move to the results. The latter leaves me with many doubts, as it seems more an excursus of events rather than a proper intervention to prove the usefulness of the cryptocurrencies in the educational sector.

- We have tried to better explain how the rewards are set in a randomized fashion, so as to be a good basis for making inference, followed by actual inference.
- The tutor-web is designed by statisticians to be a research tool for investigating students' behavior. We hope this is now clear in the paper.

2.2 Major points

I find hard to understand the research question of the paper.

- It is quite correct that the entire tutor-web and the SMLY cryptocurrency were developed as generic research tools rather than as a way to answer a single research question. Given the tools, however, it is possible to frame and test research questions which could not even have been formulated before.
- Following these comments, a section has been added describing how abusers of the system have been used to test parameter setting including the reward scheme. The same has been done with regular students.
- The section also describes how the tutor-web has (very recently) been changed to work like a cryptocurrency faucet so those who used to be abusers are now welcome to join and earn (minimal) SMLY amounts at different rates from in-class students.

In many experiments, in particular in economics, a parallel system of rewards (ECU or Experimental Currency Unit) is a standard way to explain incentives to subjects. Then, at the end of the experiment, ECU are converted into cash at a predefined exchange rate. Cryptocurrencies are not different in this respect from other way to incentivize.

- It is now explained in the paper that ECU approaches will tend to be prohibitively expensive if one is going to get a large number of western students to do some real work. Starting up a new cryptocurrency is cheap, however.
- Cryptocurrencies have one added value: They are a novelty to most students and some tech students are keen to investigate these concepts in their own right, regardless of value.

The authors used cryptocurrencies instead of valueless points to reward students' effort. Unfortunately nothing is reported about the effect of a financial incentives on students' performance. If the authors want to convince the reader that this is a good practice they should at least explain the positive externalities, if any.

- This is now included in a paragraph describing the first analyses of student/nonstudent responses as a function of the amount of the reward.

SMLY are proposed, like any other cryptocurrencies, as “funny money” with no intrinsic value.

- It is now made clear in the same section that the comparison to “funny money” only applies at the outset, not after the SMLY was registered on an exchange.

However later in the paper they also talk about an agreement with shops in campus to use SMLY as a payment method. Was the value predefined by the authors? If there is no intrinsic value then I guessed there was no way subjects they could buy coffee with them. If, otherwise, the market value was implemented, then it would have been useful to state what was it and how students could spend them.

- The pricing of coffee and other "goods" has now been expanded and explained.

If, there was a fixed exchange rate in campus, then we could not talk about “funny money” anymore.

- This is now explained first where the SMLY is introduced and also in the results section in the discussion of the valuation of goods.

It is highlighted the vary little use of SMLY by subjects. This seemed to be due to the very low value.

- Naturally the students who only earn very few SMLY have little reason to redeem those SMLY. However, students with 25 M SMLY in 2016 had actually earned about \$175 (end of semester, fall 2016) and this could be used directly to buy an airline coupon from smly.is. This is now better explained in the text.
- It is also explained how self-registered users of the system used it to earn SMLY, by registering as multiple users and solving the simplest of drills. These (ab)users redeemed almost all of their SMLY, indicating that it is possible to attract certain groups of users voluntarily into the experiments.

What is the effect of this little incentive on performance? Is it possible to explore students motivations?

- The statistical analyses now included imply a statistically significant relationship between the number of SMLY offered and the students' diligence. Thus there seems to be a signal indicating that the SMLY give an actual incentive, both for the students and the non-students.
- It is somewhat difficult to extract the students' actual motivation without in-class surveys on this topic and these are not currently available.
- It must be kept in mind though that the student body are mostly non-math majors.

There is an interesting bulk of the literature showing how wrong incentives crowd-out motivation (see e.g. Gneezy and Rustichini, 2000, ‘Pay enough or don’t pay at all’).

- This is a very interesting point.
- We have added descriptions and analyses of the responses of students and non-students as well as more references to the economic literature. The non-students were abusers of the system, for whom SMLY were at the core (they continuously redeemed their SMLY). Following an array of abuse after the submission of this paper, the whole system has been changed to accommodate these abusers in a more regulated manner (they can now use the system as a lower-value faucet whose trickle can be regulated independently of actual students).

Any statement about the use of coins is not supported by statistical tests.

- An analysis and a statement have been added to this effect, reporting significance from analyses of effects of variable SMLY rewards.

2.3 Minor points

I have noticed many links to Wikipedia pages. As they could change and control over these may not be excellent, I suggest them to use different references.

- The reference section should look like an ordinary list of scientific references, although there are a few some references to code sources and e.g. Nakamoto's original Bitcoin paper even though this is not a formal publication in a scientific journal.
- In addition to traditional references, the paper uses footnotes to add explanations or links to sites providing further information. Websites are "original" sites whenever we have found them. However, much of the detail is simply not available outside web pages (i.e. as scientific publications). In footnotes we have therefore included links to the pages we have felt included the "best" page for further information in each case.
- In several places we have had problems finding "proper" scientific references. To some extent this is a "feature" of the field, where new concepts are commonly developed and tested in code without any corresponding peer-reviewed publication. In such cases we have left links in footnotes without any other reference.