Use of a Student Response System in Primary Schools — An Empirical Study

Joan Lu[1*], Mike Joy[2], Gail Newton[3], James Robert[3], Mohammed Yousef[3], Simon McKenna[1]

[1] Huddersfield University, Huddersfield, UK.

[2] Warwick University, Coventry, UK.

[3] Federation of Scapegoat Hill J&I and Linthwaite Clough JI&EY Schools, Huddersfield, UK.

* Corresponding author. Tel.: 00441484472922; email: j.lu@hud.ac.uk

Manuscript submitted March 7, 2018; accepted June 4, 2018.
doi: 10.17706/ijeeee.2019.9.4.324-330

Abstract: This paper reports a pilot study for a student response system (SRS) used in an English school. The technology used is the "Wireless Response System" – WRS developed at Huddersfield University, and the learning activities were conducted in Mathematics and English classes. The main concepts – activity based, problem based and opinion based learning – are adopted into the study. A case study was the method used in the investigation. The results show that the system is suitable for different sizes groups of users, who may choose their preferred question types. The school claims the use of WRS was successful, evidenced by the data collected, and the children and teachers were interested in using it. We conclude that the SRS can assist teachers in classroom teaching at primary school level, especially in the observations of engagement and effectiveness of students' learning.

Key words: Mobile learning, student response system, primary school, teaching and learning, engagement, confidence, active learning.

1. Introduction

A Student Response System – SRS – is popular in educational communities, especially in Northern American and European universities where it has been in use for more than 20 years [1]-[17]. Following a previous conference publication [18], this paper continues discussing the impact of SRS on young children's learning interests, behaviors and outcomes. The research approach uses a set of case studies to observe and analyze the data collected from different topics.

2. Related Work

Anthony *et al*. used an SRS to evaluate students' perceptions of the Socrative application [6], Suzanne *et al*. addressed the learning effectiveness of SRSs [7], and Nicholas *et al*. discussed student engagement when using an SRS [8]. Melody's article argued about the advantages and disadvantages of using an SRS [9], and Grez *et al*. talked about using an SRS to improve student presentation skills [10]. George provided some interesting facts relating to teaching students how to think [11], and his article could be a good inspiration for using an SRS to improve teaching. It follows that although some arguments for using or not using such a system are still the subject of debate – e.g. commercial products may not be cost effective, devices may not be flexible, networks may be unreliable, there are issues of efficiency in data storage and retrieval, and there are barriers to staff familiarity with the technologies – the contributions to higher educational institutes are generally accepted [5]. However, the contribution to a primary school is hardly reported in the literature.

Unlike traditional use of SRSs in higher education, this paper reports an empirical study of using an SRS in an English primary school. The school teachers are responsible to look after and guide the children when using the technology. The children involved were from age 7 to 11 years old, reading in key stage 2 (KS2), and at the end of KS2 the children take academic assessments (SATs) in English and Mathematics. For English, comprehension of spelling, punctuation and grammar (so called "SPaG") forms one of children's main learning tasks. For both subjects, teachers follow the requirements of national curriculum.

3. Technology Employed

The project was carried out in the Linthwaite Clough Junior Infant and Early Years School that has a strong academic team in teaching and learning, in Huddersfield in the UK. Several groups of pupils, including one consisting of academically able children, were organised to join the project. Using the SRS for Mathematics learning was arranged as the first activity, and then learning SPaG as the second.

The technology used is a system developed in Huddersfield University. The system has been supported by four EU grants since 2009 and has been used in more than 10 EU universities, colleges and industrial companies. As it is a research project, the detailed technical development has been reported to the funders, and academic outcomes have been published in international journals and conferences [12]-[15].

To support the school to conduct the project, the University provided several handheld devices to the school. The teachers also used their own devices, including netbooks. For the trial, the University provided free software for both staff and pupils to use.

4. Question Preparation and Data Collection

4.1. Select Question Types for Learning Mathematics

Normally learning mathematics is based on an activity of problem solving. When children are learning arithmetic, they are expected to have a definite answer. For example, there is only one correct answer from the calculation of addition. However, for some reasoning questions, children can input text to provide their answers. Thus, in this study, teachers decide to use the question types of multiple choices and text input.

4.2. Data Collected from Learning Mathematics

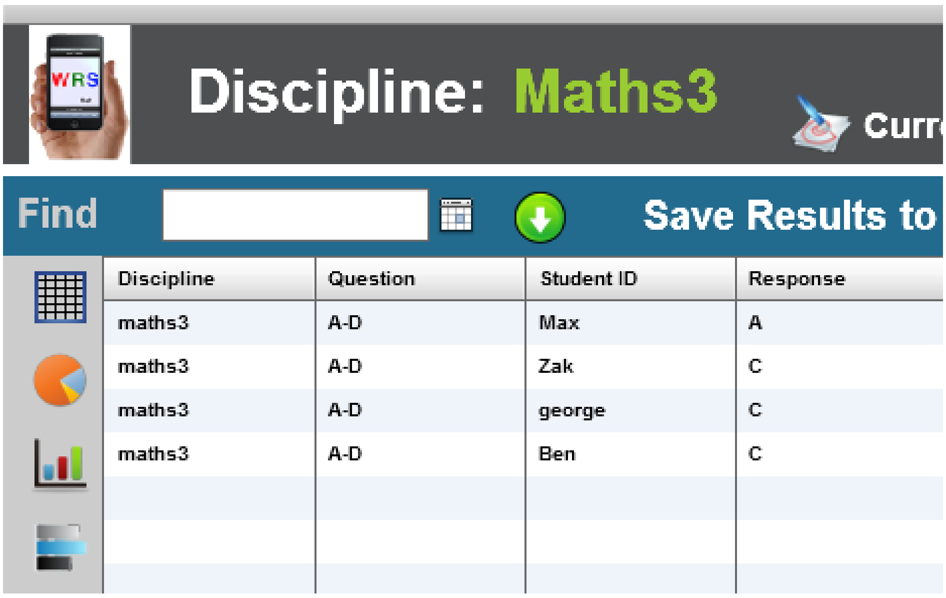


Fig. 1. Learning mathematics using WRS – case one.

Several sessions were conducted by the teachers. Figs. 1-3 show the four children who attended the activities. The teacher can display the results to the children immediately during class.

In Fig. 1, this session used a multiple choice question so that the children are very easy to operate. Where once the question is initiated by the teacher, three children answered “C”, and one answered “D”. The options are from A to D, and no child selected “B” or “D”.

In Fig. 2, this session shows a different distribution of children’s answers, for a different question, i.e. two children answered “C”, one answered “A” and one answered “D”.

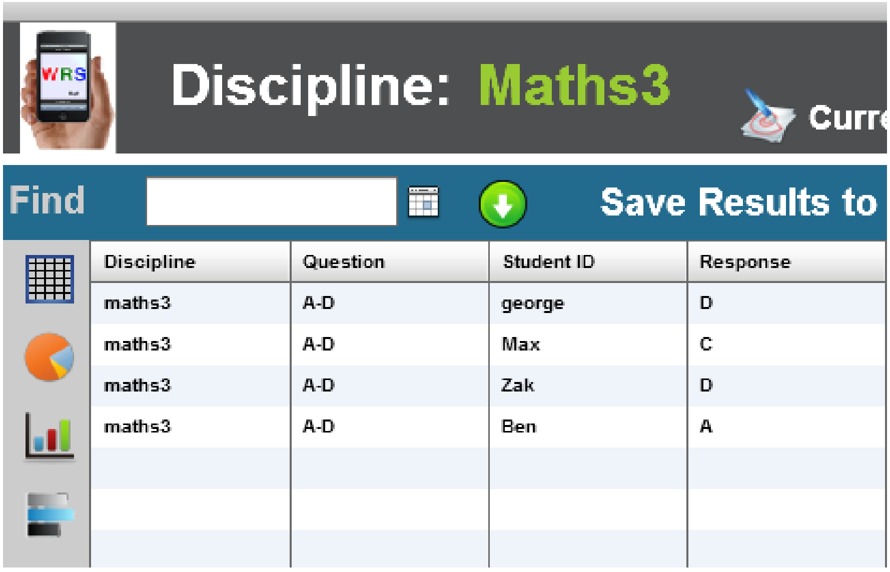


Fig. 2. Learning mathematics using WRS – case two.

In Fig. 3, this session illustrates numeric answers input by the children – in this case, all the children agreed that 180 should be the answer of the given question. Numeracy is a part of children’s learning components at key stage 2. This session addressed the importance of the learning component.

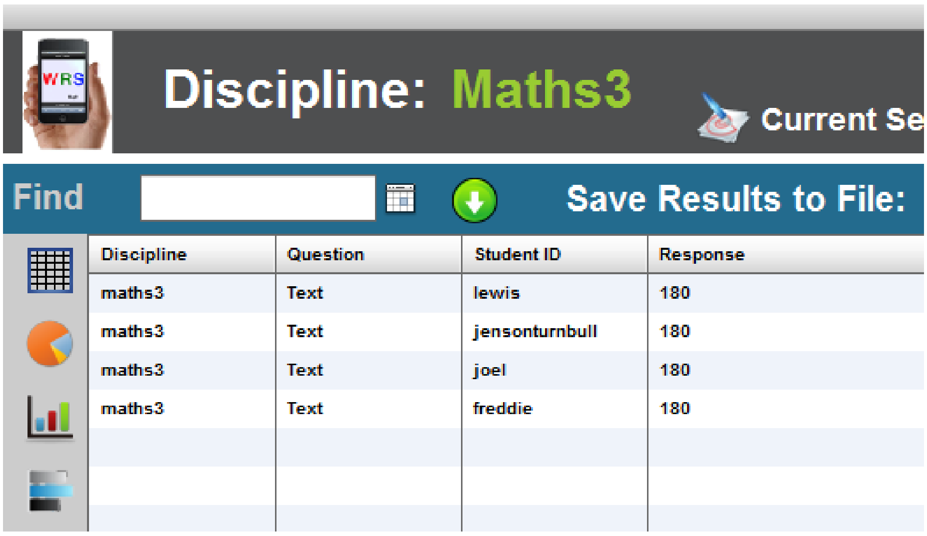


Fig. 3. Learning mathematics using WRS – case three.

4.3. Select Question Types for Learning English

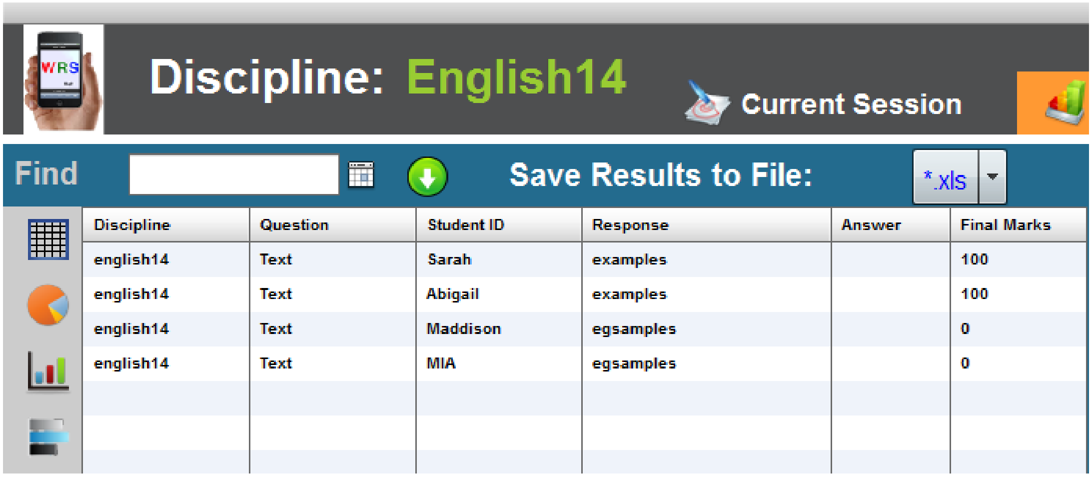
Normally learning English is based on an activity of opinion based learning. One question may have more than one answer. For example, one work may have two meanings. One sentence may have different explanations depending on the context. In this study, teachers decide to use text input. The children can input text as their answers.

4.4. Data Collected from Learning English

Learning English was the second activity, and the following evidences how SPaG learning is delivered in the classroom using the SRS. The teacher can display the results to the children immediately during class.

Figs. 4 and 5 show the evidence for learning spelling and grammar.

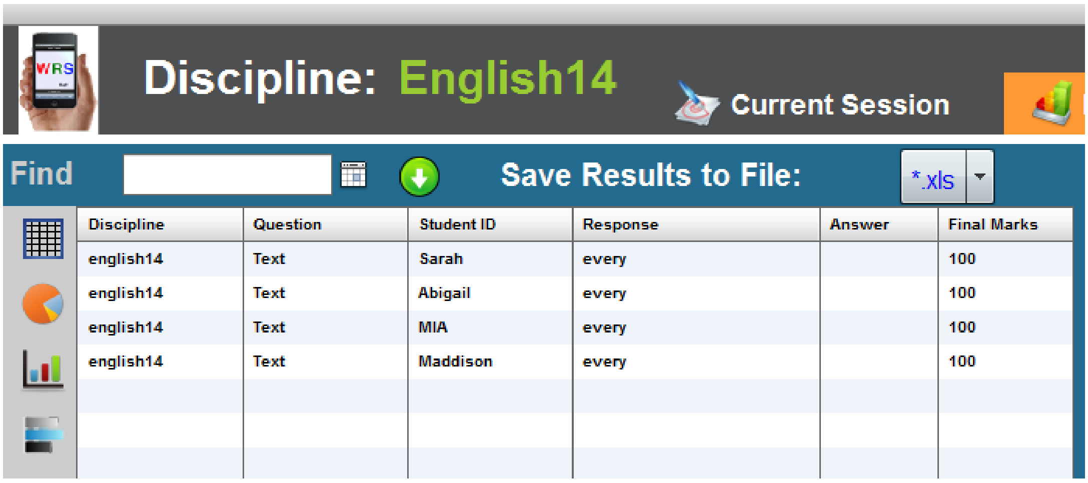
In Fig. 4, there are two children answered the question perfectly and were awarded a mark of 100. Two children input the answers different to the required answer and received a mark of zero.



Discipline	Question	Student ID	Response	Answer	Final Marks
english14	Text	Sarah	examples		100
english14	Text	Abigail	examples		100
english14	Text	Maddison	egsamples		0
english14	Text	MIA	egsamples		0

Fig. 4. Learning English using WRS – case one.

In Fig. 5, the children entering the correct answer were awarded a mark of 100. The children in this group have answered the question correctly and awarded full marks.



Discipline	Question	Student ID	Response	Answer	Final Marks
english14	Text	Sarah	every		100
english14	Text	Abigail	every		100
english14	Text	MIA	every		100
english14	Text	Maddison	every		100

Fig. 5. Learning English using WRS – case two.

5. Discussion

Generally speaking, the technology used in the school was successful as reported from the teachers [18],

[19]. With the teacher's guidance, the children are interested in using it to acquire knowledge for numeracy and literacy.

The question types designed in the system fit the purpose of teaching and learning, i.e. in numeracy, one question has one definite answer, and in literacy, one question may have multiple answers. Both multiple choices and text input can be used for the children's learning (see Figs. 1-5). These points agree with the results presented in the conference [18].

The activities can assist teachers to observe learning behaviour in a measurable way, as shown in the marked results in Figs. 4 and 5. Through these activities the teachers can immediately identify who answered questions correctly and who answered wrongly (see Figs. 1 to 5).

Pupils' engagement in the school appears strong. Pedagogically, the learning model in the school is teacher oriented and kids are listening to the teachers. Thus, the pupils found it relatively easy to engage in the activities, while in universities, learners are relatively independent, thus, the engagement issue is always a challenge, as discussed by Nicholas *et al*. [8].

Meanwhile, the learning effectiveness has been observed as the results can be viewed at the time of the running the class. The children may receive the necessary support in time if they have not understood the lesson. This point agrees with Suzanne *et al*. [7].

The technology, to some extent, may help teachers to teach based on the capabilities of children, see Figs. 3 and 5. Thus, the children's great potential can be observed because the evidence has shown that one group of pupils always performed well with given questions (see Fig. 5). This group of children can be identified as able children. Meanwhile, the children who need additional help can be identified as well, according to the subject that they need the help with, e.g. is it fractions in Mathematics, or spelling, punctuation or grammar in English?

The technology facilitates a timing effect that may help learners to be aware that the question must be finished within a given time, also, an audio effect to let leaner concentrate on the answering question.

However, the project is a pilot study. The system is still not perfect and needs further improvement in terms of data visualisation and integration of data analytic tools.

6. Conclusion

The pilot trials of SRS conducted in the English school were well organised and coherent, which resulted in a successful outcome. We can therefore draw the following conclusions.

- The learning effectiveness of using the SRS has been observed in the classroom and potential bright pupils could be identified easily.
- The engagement of pupils has worked well, although the learning models for children are different from those for adults.
- The SRS needs further research to move forward, especially for data visualization and data analytic tool integration.

Acknowledgment

The authors are grateful for the support provided by Gail Newton, Headmaster of the English School, Huddersfield, and financial support from the European Union and the University of Huddersfield CVF fund.

References

[1] Lowery, R. C. (2005). Teaching and learning with interactive student response systems: A comparison of commercial products in the higher-education market. *Computing and Information Science*.

[2] Beaty, I. (2004). Transforming student learning with classroom communication system. *Research*

Bulletin, 3, 2-13.

[3] Nayak, L., & Erinjeri, J. P. (2008). Audience response systems in medical student education benefit learners and presenters. *Academic Radiology, 15(3)*, 383-389.

[4] Hunsu, N. J., Adesope, O., & Bayly, D. J. (2016). A meta-analysis of the effects of audience response systems (clicker-based technologies) on cognition and affect. *Computers & Education, 94*, 102-119.

[5] Guarascio, A. J., Nemecek, B. D., & Zimmerman, D. E. (2017). Evaluation of students' perceptions of the socrative application versus a traditional student response system and its impact on classroom engagement. *Short Communication, Currents in Pharmacy Teaching and Learning, 9(5)*, 808-812.

[6] Galal, S. M., Mayberry, J. K., Chan, E., Hargis, J., & Halilovic, J. (2015). Technology vs. pedagogy: Instructional effectiveness and student perceptions of a student response system. *Currents in Pharmacy Teaching and Learning, 7(5)*, 590-598.

[7] Thomas, N. J., Brown, E. A., & Thomas, L. Y. (2015). Use of student response and engagement systems in the collegiate classroom: An educational resources review. *Journal of Hospitality, Leisure, Sport & Tourism Education, 17*, 59-61.

[8] Fisher, M. T. (2018). Still fighting the good fight: An analysis of student activism and institutional response. *Public Relations Review, 44(1)*, 22-27.

[9] Grez, D., & Berings, V. (2010). Student response system and learning oral presentation skills, *Procedia - Social and Behavioral Sciences, 2(2)*, 1786-1789.

[10] Mobus, G. E. (2018). Teaching systems thinking to general education students. *Ecological Modelling, 373*, 13-21.

[11] Lu, J., Meng, Z., Lu, G., & Stav, J. (2010). A new approach in improving operational efficiency of wireless response system. *Proceedings of the IEEE 10th International Conference on Computer and Information Technology (CIT)* (pp. 2676-2683).

[12] Meng, Z., & Lu, J. (2011). Integrating technical advance in mobile devices to enhance the information retrieval in mobile learning. *International Journal of Information Retrieval Research (IJIRR), 4(1)*, 61-85.

[13] Pein, R., Lu, J., & Stav, J. (2009). Integrating mobile computing solutions into distance learning environments. *Proceedings of the International Conference on Mobile Communications and Pervasive Computing (MCPC 2009),* Leipzig, Germany.

[14] Meng, Z., & Lu, J. (2011). Opportunities of interactive learning systems with evolutions in mobile devices: A case study. *Proceedings of the 2011 International Conference on Internet Computing ICOMP 2011* (pp. 238-244).

[15] Meng, Z., & Lu, J. (2011). Implementing the emerging mobile technologies in facilitating mobile exam system. *Proceedings of the 2nd International Conference on Networking and Information Technology* (pp. 80-88).

[16] Lu, J. (2012). *Learning with Mobile Technologies, Handheld Devices, and Smart Phones: Innovative Methods*. Hershey, PA, USA: IGI Global.

[17] Manga, F., & Lu, J. (2013). An investigation in the impact of mobile learning on today's educational environment. *Proceedings of the 2013 International Conference on e-Learning, e-Business, Enterprise Information Systems, and e-Government* (pp. 130-135).

[18] Lu, J., Joy, M., Newton, G., Robert, J., Yousef, M., McKenna, S., Sinclair, J., & Allen, G. (2018). Use of a student response system in primary schools — An empirical study. *Proceedings of the International Conference on Communication, Management and Information Technology (ICCMIT'18.* Madrid, Spain.

[19] Yousef, M., & Robert, J. (2016). *WRS Reports*. Linthwaite Clough JI&EY Schools.

Joan Lu is a professor in informatics at Huddersfield University. Her extensive research covers XML technology, data mining, information retrieval/extraction and visualization, mobile computing and distributed system, such as cloud computing, technology enhanced learning. She has served as BCS examiners for advanced database management system, published 7 academic books in the subject area. She has been the investigator for mobile learning systems for four EU sponsored projects from 2009 to present.

Mike Joy is a professor in computer science at the University of Warwick, is an information systems engineer with particular interests in educational technology, object-oriented programming, and internet software.

Gail Newton is headmaster in Federation of Scapegoat Hill J&I and Linthwaite Clough JI&EY Schools, Huddersfield, UK.

James Robert is an experienced KS2 teacher in Federation of Scapegoat Hill J&I and Linthwaite Clough JI&EY Schools, Huddersfield, UK.

Mohammed Yousef is an experienced KS2 teacher in Federation of Scapegoat Hill J&I and Linthwaite Clough JI&EY Schools, Huddersfield, UK.

Simon McKenna is a senior business development manager in School of Computing and Engineering, University of Huddersfield, UK.

Jane Sinclair, associate professor of computer science at the University of Warwick, has an extensive research background in educational technology and computer science education.