INVESTIGATING 'VOICE EMAIL' TECHNOLOGY EFFICACY IN INFORMATION MANAGEMENT ASSESSMENT

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ABSTRACT

This paper introduces the use of 'voice emails' as an approach to improving formative feedback and describes how such technology can be embedded within curricula. A quasi-experimental study was conducted with a student sample (n = 42) comparing audio and written approaches to feedback delivery. Student performance at formative and summative assessment points was analysed and the influence of the feedback format used was studied. The ability of voice emails to better meet recognised theoretical models of 'quality' formative feedback was also investigated using a specially designed web survey research instrument. Results reveal that in most instances voice email can better meet the conditions of formative feedback thus enhancing the student learning experience. Results from the study also suggest that voice email feedback, although offering many positive applications to lecturers, may not significantly improve the learning of students.

Keywords

Audio feedback, voice emails, formative assessment, audio technology

1. INTRODUCTION

Formative feedback can be used by students to amend their learning behaviour thus promoting 'deep learning' approaches to summative assessments [5]. Despite the recognised importance of formative assessment [1, 5], few such opportunities are made available to students within Higher Education (HE). This issue is often attributed to structural constraints, such as the limited time lecturers have within semester-based systems to produce feedback, increased student-to-staff ratios and the demands of scholarly activity. Gibbs and Simpson [1] propose a series of conditions to be met if formative feedback is to be effective and used meaningfully by students. Included within these conditions are that it be sufficiently detailed (condition 4), understandable (condition 8) and received by the students "while it still matters" (condition 6). Structural constraints often mean that when formative feedback is delivered it is insufficiently detailed, providing the student with limited feedback on how their performance relates to course expectations and how it can be improved. Furthermore, feedback will often be difficult to interpret, employing language and jargon that students have difficulty understanding (e.g. "This is insufficiently critical", etc.) [5]. This is further complicated by assessment tasks themselves, the nature of which students rarely understand, thus making feedback interpretation even more difficult [1]. Formative feedback may be sufficiently detailed and understandable but will be of limited use if the student has little time to act on it prior to summative assessments.

The use of audio technologies to deliver feedback of all types has recently attracted attention from the learning technology community and research has demonstrated student satisfaction with such technologies [6]. In this paper we introduce the use of 'voice emails' as a potential solution to some of the above noted difficulties and report on the findings of a study designed to evaluate the efficacy of *voice emails* in delivering formative feedback to degree course students studying a business information management module. We also evaluate the ability of voice emails to better meet recognised theoretical models of quality formative feedback and investigate the potential of audio feedback to enhance student learning.

2. AUDIO FEEDBACK

Recent advances in audio technologies have enabled the creation of audio-based learning materials (e.g. podcasts), often to promote m-learning. Research evaluating the effectiveness of such technologies to deliver feedback unfortunately remains limited. Students' perceptions and use of audio feedback have been investigated by a number of researchers [e.g. 2, 4, 6], all of whom found students to respond positively to audio feedback primarily owing to its personal nature and because it was more detailed and easier to interpret

than written feedback. Capturing greater feedback detail and improving feedback delivery times has also been identified by several researchers as a potential advantage of audio feedback and a solution to the poor formative assessment opportunities at HE; however, results remain variable [2, 3] and some studies lack objective measurements [6].

Perhaps most interesting is the potential of audio feedback to affect improvements in learning. If audio feedback provides opportunities for better meeting the conditions of quality formative feedback then it can be hypothesised that students receiving it may experience improved learning prospects. Evidence gathered by a number of studies has indicated that audio feedback may be capable of enhancing student learning more than other feedback methods [e.g. 2, 3, 7]. However, evidence remains unsatisfactory and further research is required to increase our understanding of the link between formative feedback delivered as audio and enhanced student learning.

3. METHODOLOGY

Wimba Voice (http://www.wimba.com/products/wimba_voice/) was installed within *Blackboard* to deliver audio feedback. *Wimba* is a web-based plug-in suitable for a variety of Virtual Learning Environments (VLE) and provides a variety of audio tools (e.g. podcaster, voice enabled discussion fora, etc.). It also enables the creation of *voice emails*. These are voice messages which can be recorded and delivered to students using an email / tape recorder interface within a Java enabled browser. Students receive an email with a hyperlink directing them to an audio file stored on a local server, thus obviating MP3 file size issues which can often cause technical issues in feedback delivery [4]. *Wimba* also allows students to reply to tutors with their own voice email. *Wimba voice emails* were used to deliver formative audio feedback to students in our study.

Voice (*n*=21)	**Male**		**Female**		**Sub-total**		**Written (n=21)**	**Male**		**Female**		**Sub-total**	
Age	***n***	**%**	***n***	**%**	***n***	**%**	**Age**	***n***	**%**	***n***	**%**	***n***	**%**
18-24	3	14	14	67	17	81	18-24	3	14	18	86	21	100
25-29	0	0	3	14	3	14	25-29	0	0	0	0	0	0
30-34	0	0	1	5	1	5	30-34	0	0	0	0	0	0
Total	**3**	**14**	**18**	**86**	**21**	**100**	**Total**	**3**	**14**	**18**	**86**	**21**	**100**

Figure 1: Demographic details of study participants and composition of streamed groups.

Study participants were drawn from a first year cohort studying a web technologies and business information module as part of a BA (Hons) Business and Public Relations degree course. Forty two students agreed to participate in the research (Figure 1). All students received a *Wimba* orientation session to control for varying levels of ICT efficacy and an instructional video was also made available via *Blackboard*.

The summative assessment for the module required students to submit an XHTML report. A formative assessment point was created mid-way through the module for which students submitted an XHTML report plan, thus enabling tutors to deliver formative feedback on student learning and understanding. Students were then randomly streamed into a written group (control) (n = 21) and a voice (email) group (treatment) (n = 21) (Figure 1). Marking criteria were agreed among tutors and, where possible, feedback attempted to follow recognised models of quality feedback [1, 5]. For the purposes of our research, students' formative assessment performance was recorded for future analysis. Note that this mark was not disclosed to student participants. Formative feedback was then delivered to students (within a week), with written feedback students receiving their feedback as an MS Word file and the voice group receiving a voice email.

A web-based survey instrument was administered during a timetabled IT lab one week after feedback was delivered. The survey was designed to gather a wide range of data; however, of relevance to this paper was section two of the survey in which students were required to indicate their responses to a series of statements using a five point Likert scale, ranging from *strongly agree* (5) to *strongly disagree* (1). This section was specially designed to determine how well formative feedback achieved its purposes and to detect effects on student learning. The statements used in section two map to recognised formative feedback models [1, 5].

4. RESULTS AND DISCUSSION

Figure 2 sets out the results from section two of the web-based survey instrument. Responses from both groups were generally positive, indicating a high level of student satisfaction with their formative feedback irrespective of whether this was delivered as a voice email or in written form. Noteworthy median differences can be observed for statements J (M_{voice} = 2.476, MDN_{voice} = 2; $M_{written}$ = 2.905, $MDN_{written}$ = 3), M (M_{voice} = 3.905, MDN_{voice} = 4; $M_{written}$ = 3.238, $MDN_{written}$ = 3) and O (M_{voice} = 4.334, MDN_{voice} = 5; $M_{written}$ = 3.952, $MDN_{written}$ = 4). A Mann-Whitney U test was conducted to detect significant differences between group

responses (Figure 2). Statistically significant differences ($p < 0.05$) between group responses were found for statements D, H, K and M, indicating students in the voice email group found their formative feedback to better meet conditions of *quality* feedback in terms of being understandable, clarifying assessment expectations, and inspiring motivational beliefs [1, 5]. Responses for K were significant at $p < 0.01$ ($U = 128$, $Z = -2.570$, $p = 0.01$). It is also worth noting the generally positive mean scores recorded for many of the voice email question statements.

Survey statements – section two	Voice email		Written		*U*	*Z*	*p*-value[a]
	M	***Mdn***	***M***	***Mdn***			
a. I was satisfied with the feedback provided	4.286	4	4.095	4	181.5	-1.325	0.185
b. I found the feedback to be clear and understandable	4.286	4	4.095	4	175	-1.357	0.175
c. The feedback I received helped me 'troubleshoot' or self-correct my performance on the module and the final assessment	3.952	4	3.762	4	193.5	-0.772	0.440
d. The feedback clarified or made explicit what is required of me in order to improve my academic performance on the module and the final assessment	4.238	4	3.762	4	148	-1.981	0.048*
e. The feedback helped me reflect on my learning	3.810	4	3.714	4	211.5	-0.244	0.807
f. The feedback helped me understand where to focus my efforts so that I can better improve my university coursework	3.905	4	3.905	4	220.5	0.000	1.000
g. I considered the feedback to be sufficiently personal and relevant to me	4.238	4	3.905	4	163	-1.612	0.107
h. I found the feedback to be easy to comprehend	4.190	4	3.809	4	157	-1.959	0.050*
i. I felt the feedback was sufficiently detailed	4	4	3.619	4	155	-1.814	0.070
j. I found the feedback to be too brief	2.476	2	2.905	3	170.5	-1.329	0.184
k. The feedback was cryptic or difficult to interpret	1.810	2	2.476	2	128	-2.570	0.010*
l. The feedback helped to increase my interest in the module I am studying	2.952	3	2.905	3	206.5	-0.393	0.694
m. I felt motivated after reading/listening to my feedback	3.905	4	3.238	3	132.5	-2.378	0.017*
n. The feedback was delivered in a timely fashion	4.095	4	4.286	4	189.5	-0.882	0.378
o. I intend to use the tutor feedback later in the module	4.334	5	3.952	4	157	-1.754	0.079
p. I was afforded sufficient opportunity to seek follow-up tutor feedback (e.g. Questions)	3.524	4	3.667	4	196.5	-0.679	0.497
q. It is important that my feedback is delivered electronically	3.667	4	3.619	4	208	-0.329	0.742
u. I prefer to receive my feedback electronically	3.524	4	3.905	4	182.5	-1.011	0.312

[a]Two-tailed Mann-Whitney U test (adjusted for ties). Sig. at $p < 0.05$.

* $p < 0.05$.

Figure 2: Measures of central tendency and M-W U tests between groups for section two responses.

Students' formative and summative assessment performance are presented in Figures 3 and 4. The performance in the formative assessment was expected and was similar in both the voice email and written groups, with slightly more dispersion around the mean in the voice group. This was confirmed by an unpaired two tailed t-test at $p = < 0.05$ ($t(40) = 1.36$, $p = 0.182$).

Formative performance measure	Voice (*n* = 21)	Written (*n* = 21)	Summative performance measure	Voice (*n* = 21)	Written (*n* = 21)
M	45.38	40.19	*M*	40.86	40.91
SD	14.89	9.12	*SD*	17.35	19.74
R	44	34	*R*	51	55

Figure 3: Student performance in formative and summative assessment (mean, standard deviation, range).

Unfortunately, performance for both groups in the summative assessment was poor. There was little observed improvement from the formative assessment, with a mean percentage learning gain of -4.52 and 0.72 noted for the voice and written groups respectively. This result was unanticipated and is contrary to the findings of a similar study [3]. It is nevertheless encouraging that marks of > 40% can be observed in the summative performances of both groups, with numerous students in both groups reaching > 55% and some

students exceeding 70% (Figure 4). An unpaired two tailed t-test at $p = < 0.05$ revealed no significant differences between group performances for the summative assessment ($t(40) = 0.008$, $p = 0.993$).

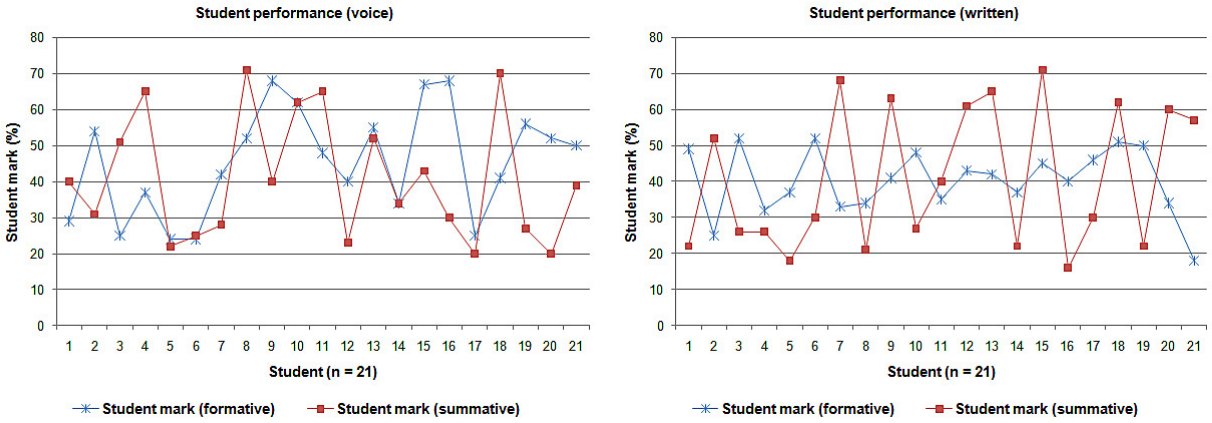

Figure 4: Student performance in formative and summative assessment (voice and written).

Students were expected to publish their XHTML report on the University server as part of the assessment. Failure to do this correctly meant that tutors were unable to access the report via HTTP, for which marks were assigned. A large proportion of students (52%, $n = 22$) failed this aspect of the assessment and as a direct consequence achieved marks < 40%. These students were spread equally across both groups ($n = 11$). If such outlying data is removed from the dataset we can observe improvements in the summative assessment marks for both groups (Figures 5 and 6), with improved mean percentage learning gains ($M_{voice} = 10.52$; $M_{written} = 19.81$) and the graph profile of the written group mirroring formative performance. Although the data indicates a superior summative performance and higher learning gains for the written group, the difference between groups was not statistically significant ($t(18) = -0.841$, $p = 0.413$). This finding appears to corroborate the findings of previous research [3].

Summative performance measure	Voice ($n = 10$)	Written ($n = 10$)
M	55.9	60
SD	11.51	8.79
R	31	31

Figure 5: Student performance in summative assessment (outliers removed).

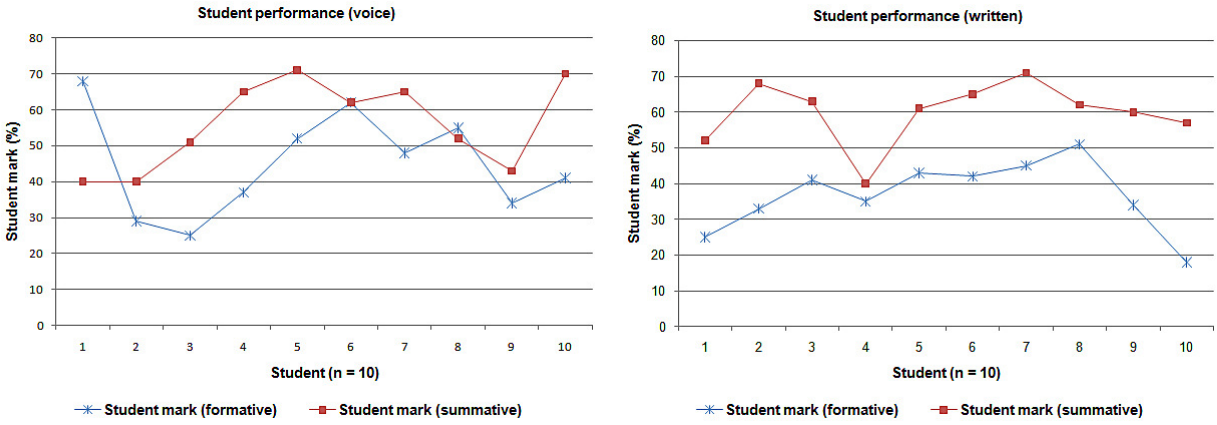

Figure 6: Student performance in formative and summative assessment (outliers removed).

The time demands of tutors generating voice email feedback were considerably smaller and indicate that using audio was 40% quicker to create and deliver (Figure 7). Less variability in the amount of tutor time spent marking individual submissions was also observable from the reduced data dispersion ($M_{voice} = 0.17$, $R_{voice} = 1.06$; $M_{written} = 1.11$, $R_{written} = 4.40$). To enable comparisons between feedback delivery times of different tutors, a random sample of submissions ($n = 12$) was used prior to data collection to detect for any variance in tutors' delivery of both audio and written feedback. The time taken for both tutors to complete feedback for this test sample was similar and did not differ significantly for either voice emails ($t(10) = 1.52$, $p = 0.16$) or written feedback ($t(10) = -0.61$, $p = 0.56$). The results presented in Figure 7 therefore appear to be an accurate reflection of the time efficiencies possible when using audio feedback approaches. It is worth commenting that the use of voice emails probably contributed to improvements in the time efficiencies by

obviating any need for specialist audio software or recording equipment and by removing file transfer issues and other technical issues (e.g. difficulties attaching large MP3 files to emails) which can often limit the time reductions possible [6].

Feedback group	*M*		*SD*		*R*	
	Dec. (5dp)	**Min/Sec**	**Dec. (5dp)**	**Min/Sec**	**Dec. (5dp)**	**Min/Sec**
Voice	0.06407	3.50	0.00475	0.17	0.01861	1.06
Written	0.10309	6.11	0.01999	1.11	0.07778	4.40

Figure 7: Time requirements for delivering voice email and written feedback.

5. CONCLUSION

Our quasi-experimental study compared the efficacy of audio and written approaches to formative feedback delivery and introduced the use of *voice emails* as a means of delivering formative feedback to students undertaking an information management module. The results indicate that voice emails better meet recognised theoretical models of *quality* formative feedback thus enhancing the student learning experience. Voice emails were found to clarify assessment expectations, to be more understandable, and to inspire motivational beliefs. It was disappointing that the increased detail and personal nature of voice emails was not found to be statistically significant; however differences in mean responses were observed indicating enhancements in this respect. Results from the current study therefore suggest that although audio feedback may enhance the learning experience, it may not significantly improve student learning. It is nevertheless encouraging to note that voice emails appear to promote greater use of formative assessment by reducing the time commitments of formative feedback delivery. It is our intention to merge data from this study with that of a previous study [3]. Extensive qualitative data was also gathered from student participants using semi-structured interviews, the coding of which provided useful additional data on the learning effects of voice email in formative assessment. We expect the results of both to be published in the academic literature in due course.

6. ACKNOWLEDGEMENTS

This research was conducted as part of a wider project (ExAEF Project) funded by the HEA Subject Centre for Information and Computer Science (2009). Their support is gratefully acknowledged by the authors.

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