

Evaluation of low-cost Personal Digital Assistants (PDA) for field data collection and fieldwork leadership by students and staff

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Abstract

This project evaluated low-cost (< £200, 2006 UK prices) PDAs for use by students in field data recording, and two advanced model PDAs for use by staff in fieldwork leadership. The low-cost PDAs will also, undoubtedly, come down in price over the next year or two, offering the possibility of providing all students with such a device to assist in field data collection and other aspects of their University studies. Improvements in memory capacity will also offer greater functionality for storing notes, handouts, lecture presentations, video and audio files. However, the low-cost PDA models are not waterproof, which is a major drawback for field use. Field use of PDAs offered clear benefits to teaching and learning, particularly as students were able to record their data onto PDAs in Excel, and copy files to a central PDA (managed by a staff member) via Bluetooth. The staff member could then download files to a lap top or desktop docking station and email them to the rest of the students. Data files can also be transferred to students' mobile phones, iPods etc if they have Bluetooth. Use of a lap top in the field ensured that students could obtain copies of data files using data pens (which most of the students had) or directly via SD cards (available in many digital cameras owned by students). This makes the sharing and backup of data in the field readily possible and overcomes the problem of hand written field notes getting wet, muddy or lost. It enhances students' ability to organise and share their group data, share field notes and observations, and to improve their subsequent preparation of assessed field reports.

Background

Recent advances in mobile technologies, in particular in hand held computers and personal digital assistants (PDAs), have the potential to be used by students for data collection in fieldwork, and by staff for leadership and organisation tasks. To date, few studies are available from which we can evaluate the use of PDAs by students during fieldwork. Bishop Burton College (JISC Innovative Practice with e-Learning, 2003) for example, has used memory expansion cards with Hewlett Packard (HP) PDAs to store a database of plants containing 1,400 images. Such devices have the potential to make field maps, diagrams, images (eg. photos which expand timescales) and short video clips available to learners in field situations, to enhance learning, undertake assessment and to give feedback. The incorporation of global positioning systems (GPS) into newer models (eg. Trimble) is also being trialled in fieldwork by some universities (eg. Nottingham University). However, PDAs capable of these GPS/GIS functions are an order of magnitude more expensive than the low-cost ones evaluated in this study.

During field investigations, students typically worked in groups of 3-4 to collect data for the problem set.

The project's aims were:

1. To evaluate low-cost (< £200, 2006 UK prices) PDAs for use by students in field data recording situations,
2. To evaluate two advanced model PDAs for use by staff in fieldwork leadership.

Following a market survey of PDAs the following were purchased for evaluation in this study (Fig. 1):

- 4 x Hewlett Packard HP hx2190 Pocket PCs with leather case and waterproof Ortlieb map case (Fig. 1A)
- 1 x Hewlett Packard HP hx4700 Pocket PC with external GPS and leather case (Fig. 1B)
- 1 x Hewlett Packard HP hw6516 Mobile Messenger Pocket PC with Quad band GSM, internal GPS and GPRS receiver (mobile phone) and integrated camera (Fig. 1C)



Fig. 1A: Hewlett Packard HP iPAQ hx2190 Pocket PCs



Fig. 1B: Hewlett Packard HP hx4700 Pocket PC



Fig. 1C: Hewlett Packard HP hw6516 Pocket PC

All three models of Pocket PC operate with the same software—Windows Mobile™ 2003 second edition, which comes pre-installed. The programs include: ActiveSync (to synchronise the pocket PC with a desktop or lap top; pocket versions of Word, Excel, calendar, contacts database, Internet Explorer; Clear Vue PDF, and Presentation; HP Image zone; Windows Media Player; and, for the hw6516 only, HP Photosmart and SIM Manager. Interactivity between the models (via Bluetooth), and learning to use the software was facilitated by the fact that all three models operate with the same software.



Fig. 2: Using HP hx2190 PDA to record field data during river survey in Langdale, Cumbria



Fig. 3: Using HP hx2190 PDA to record field data during river survey in Langdon Brook, Forest of Bowland, Lancashire.



Fig. 4: Using HP hx2190 PDA to record field data during cave survey in Great Douk Pot, Ingleborough, North Yorkshire.

Methods

Opinions on the usefulness of the PDAs were gathered from both students and staff.

A. Student evaluation

The PDAs were used during fieldwork on four modules during March / April 2006:

1. BIEES2026: Glacial & Fluvial Processes – river survey in Langdale, Cumbria on 16 March 2006. (Fig. 2).
2. OLFE01202: Geographical Basis of Outdoor Education - Micro-climatology practical/fieldwork on Mon 20th and Fri 24th Mar-06 (Ainsdale dunes, Formby)
3. OLFE02003: Earth Surface Processes – rivers fieldwork in Trough of Bowland on Wed 22nd Mar-06 (Fig. 3)
4. OLFE02202: Caving & Karst Landscapes 3 -7 April: North Yorkshire - cave survey and cave science (Fig. 4).

During field investigations, students typically worked in groups of 3-4 to collect data for the problem set. One PDA was allocated to each group of three to four students, so usually one student volunteered to take charge of the PDA and had the responsibility for recording the data. In this study, the PDAs were primarily used for recording field data in Pocket Excel, where recording templates had been designed and pre-installed on the PDAs. Students using the PDAs were given a short oral briefing on how

to turn on the PDA and how to access the prepared Excel recording template. Little further instruction was needed, though the staff member remained available throughout the field survey in case help was required. All students were familiar with the use of Excel on a desktop PC. The use of the PDAs by students was evaluated immediately after its use in the field by means of a simple questionnaire (Fig. 5).

B. Staff evaluation

The staff evaluation was based on using the HP hw6516 daily for nine months, primarily as a: diary and contacts list (using Outlook calendar); camera; Excel for fortnightly field data recording; Word for field notes; phone and text messaging; task list; note pad; and calculator. Microsoft Pocket Streets 2006 (build 13.0.09.0100) was installed (free download from HP web site) along with maps of Liverpool. AA navigator software was purchased and installed on the HP hx4700, which was evaluated as an in-car Satellite Navigation System.

Results

A. Student evaluation

In total, 21 students used the PDAs for field data recording in Langdale (river survey, n = 8); Trough of Bowland (river survey, n = 4); in the Yorkshire Dales (cave hydrology and cave survey, n = 5) and in the Ainsdale sand dunes at Formby (micro-climatology survey, n = 4). Students were studying at Level 1 (n = 4) and Level 2 (n = 17). The students were drawn from four programmes of study: BSc (Hons) Outdoor & Environmental Education; BA (Hons) Adventure Tourism; BSc (Hons) Geology; BSc (Hons) Physical Geography. Thirteen of the students were male and eight were female. Five of the students had used a PDA before, while 16 had never used one.

All responses on the -5 to +5 scale, were positive (Fig. 6), with a majority of students feeling that the PDA was effective for recording field data. Specific questions about their experience of using the PDA were asked in section 3.2 and the results are shown in Fig. 7. For all questions, all students who responded (n = 17) either agreed or strongly agreed with the question, except for one student who preferred to record the data in a notebook. Table 1 gives a summary of students' written comments collected via the questionnaire.

Fig. 5: Questionnaire completed by 21 students following fieldwork with the PDA.

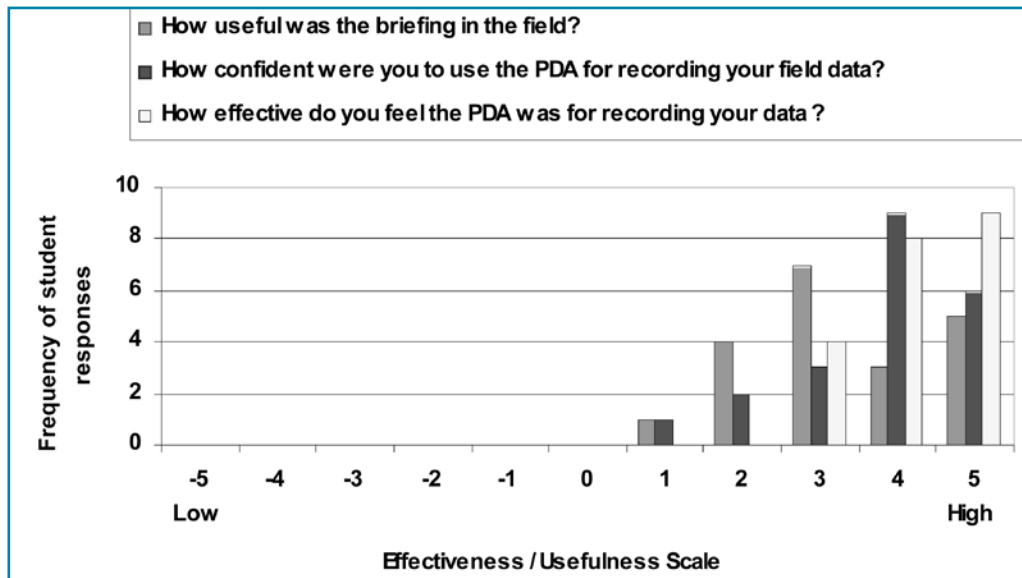


Fig. 6: Students' opinions of confidence and PDA effectiveness.

Table 1: Students' Written Comments from Questionnaire

Student Positive Comments (each comment separated by ';'):

Fairly quick to use; the data are straight onto a spreadsheet ready for analysing; quicker and less chance of collecting incorrect data; less paper to be carried, therefore less lost; when back home the data don't have to be put into excel because it's already been done in the field; no wet pieces of paper; will be easy to transfer to PC, legible results; don't need to write much; saved lots of paper flapping about in the wind; the data were recorded in an easy access format; the PDA doing my calculations and not having to write when hands very cold; quick and easy data input and calculation; allowed better layout of data than in notebook; small, easy to use, works in all weather.

Student Negative Comments (each comment separated by ';'):

The weather was bad so it was a little fiddly to use in the waterproof case; low battery and working in the rain/snow made it hard to view screen; battery life?; can't see the screen very well in sunlight; it not being waterproof; only when it snowed, protecting PDA in waterproof bag - hard to see screen and awkward to hold PDA in bag; difficult to read in sunlight and under waterproof cover when raining.

Student Suggestions:

1. Study with a PDA before using in the field, to get used to it, and draw up own prepared worksheet
2. Use them on all fieldtrips; quick and easy to use
3. Let there be more PDAs available for everyone
4. Provide bigger plastic bag for use in wet weather
5. Waterproof case instead of big bag
6. Waterproof case that fits the PDA

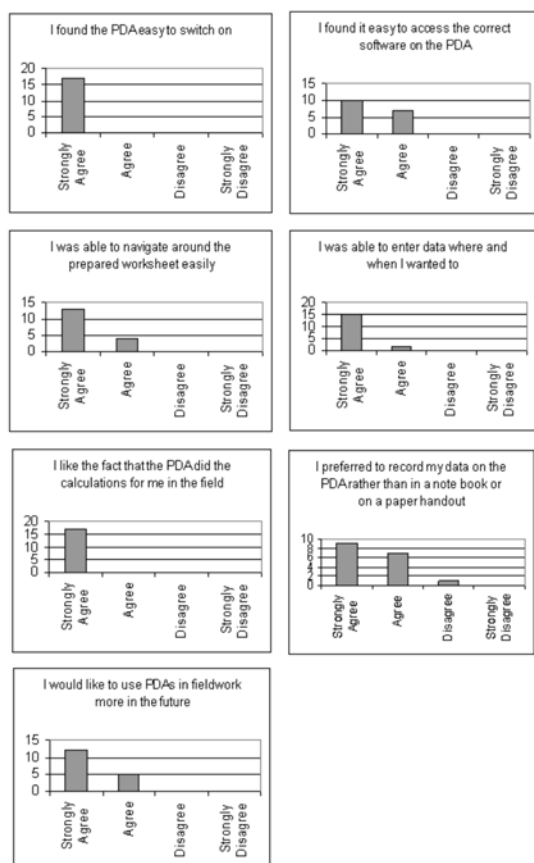


Fig. 7: Students' opinions of using PDAs for field data recording.

B. Staff evaluation

The staff evaluation results are summarised in Table 2.

Conclusions

1. Field use of PDAs offers clear benefits to teaching and learning, as using the current technology ensures the sharing of data is readily possible. The difficulty in sharing data has been a major problem with field notes in the past, but use of PDAs overcomes this issue, enhancing students' ability to organise and share their group data, share field notes and observations and to improve their subsequent preparation of assessed field reports.
2. The likely further reduction in price of the low-cost PDA models (~£200, 2006 prices) offers the possibility of providing all students with such a device to assist in their University studies. Improvements in memory capacity will offer greater functionality for storing notes, handouts, lecture presentations, video and audio files.
3. Although the low-cost PDA models are not waterproof, a major drawback for field use, the waterproof map cases provided worked. However, these did make using the PDA in bad weather more difficult. Another problem encountered was the ability to see the screen in bright sunlight, but covers that shaded the screen were deployed to help with this. The illuminated backlit screen was useful in low light conditions (eg during cave survey).

Table 2: Staff Evaluation of models HP hw6516 and HP hx4700.

Model	Programs used in Windows Mobile™ 2003 2 nd edition or function	Evaluation comments
HP hw6516 [screen 5.5 x 5.5 cm]	MS Active Sync	Synchronised all files, diary, contacts with desktop or lap top computer via a cradle which also charges the PDA
	Outlook Calendar	Synchronisation with Outlook on desktop the most valuable point, so diary and contacts are backed up. Takes some time to get used to. Slower to enter appointments than paper diary; can sync with email to send email appointments
	Contacts	Synchronises with contacts in Outlook on desktop so email contacts and emergency phone numbers are available in the field and backed up
	Task list	Useful for pre-field trip planning as reminders of tasks which need to be undertaken prior to and during field excursions
	Excel	Used fortnightly to record erosion pin survey data very successfully. Good in low light conditions as backlight illuminates screen.
	Word	Used for field notes; records of passwords, room codes etc. Can load copies of field handouts but screen really too small and lots of scrolling needed
	ClearVue PDF	Useful for reading PDF files, journal articles but screen really too small and lots of scrolling needed
	HP Photosmart	Integrated camera useful for field photos but quality too low for most uses
	HP Image zone	OK for viewing photos taken using HP photosmart or photos imported via SD card or Bluetooth
	Windows Media Player	Plays audio or video files in compressed format
	MS Pocket Streets	Free maps downloadable for major UK cities only so limited in that respect. However, zoom function allows location of addresses. Touch roads to find streetname/house numbers
	Mobile phone	Essential piece of field leader's equipment for emergency use; problem solving and keeping in contact with other members of the party. Hampered by lack of reception in many mountain areas.
	SMS text messaging	Useful for keeping in contact with other members of the party. Hampered by lack of reception in many mountain areas.
	SD card	Extra field storage available with standard and small SD card slots
HP hx4700 [screen 6 x 8.5 cm]	AA Navigator to make in-car satellite navigation system	AA Navigator (£80, 2006 prices) installed from an SD card which stores the street map coverage (UK only). Blue tooth connections with external GPS unit (requires separate charger). Both PDA and GPS unit can be charged via car 12v socket. Frequent problems getting PDA and GPS unit to talk (Bluetooth) but works OK once set up. Verbal instructions or map mode. Enter postcode or find major attractions like rail stations, hotels. Useful for navigating to field sites (??) or possibly for emergencies (nearest hospital, public transport etc). Reliability a little suspect and dependent on keeping batteries charged. Larger screen useful. Screen resolution better than hw6516.

Future possibilities

1. Groups of students could have theory slides (PowerPoint) available with them in the field (in colour) to back up practical work.
2. Students could have copies of colour photos taken during previous field visits, or during different conditions (eg rivers in flood, poor or good weather conditions) to expand their timeframe and give a different perspective (eg before/after a landuse change). (Use of historical photos is also possible.)
3. It is possible to load video clips onto PDAs, which could enhance the possibilities above even further.
4. It may be possible to record audio instructions to the PDAs, which students can play in the field. This could provide an alternative to reading handouts, though students would need their own PDA.

Acknowledgements

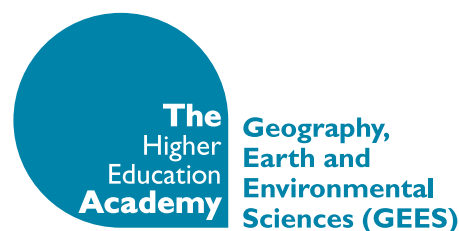
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