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Abstract:

University rankings are increasingly important internationally, and in the UK include a sustainability 'Green League'. However, there is little evidence about experiences of studying in 'sustainable universities'. We report an empirical study at five universities in varied positions in the Green League, exploring students' energy literacy, environmental attitudes and perceptions of their institution's energy-saving efforts. Although the link to energy literacy is not clear, findings suggest that there are significant differences between students' environmental attitudes at universities placed at different points in the league. In addition, students at higher ranked universities are more positive about their university's energy-saving efforts, suggesting that these institutions may exhibit more overt manifestations of sustainability. This is important since students report being more likely to choose energy-conservation behaviours if there is visible representation of energy use. The study is the first to attempt a comparison between universities at different positions in a sustainability ranking.

Introduction:

University rankings and league tables are an increasingly important part of the higher education (HE) system. In the last 15 years there has been a proliferation of league tables

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measuring everything from research results and teaching quality indicators to the cost of parking and chief executive's salary. League tables have resource implications for individual institutions – successful positioning in major rankings can guide student recruitment at home and internationally (Li et al. 2011). Sustainability (in the form of commitment to environmental improvements on campus, embedding of sustainability in the curriculum, and sometimes wider issues such as ethical investment and workers' rights) has also been subject to the league table approach – most notably in the UK, by the People and Planet Green League[1], in the US by the Sustainability Tracking, Assessment and Rating System (STARS)[2], and internationally by the UI GreenMetric[3]. The aim of such comparisons is to allow universities to benchmark against others and to inform student applications, thus the tables have a powerful marketing role. Whether sustainability league tables have the same cachet as the traditional concerns of research and teaching is uncertain since most research into student choice does not include sustainability (Bowden 2000; Hemsley-Brown and Oplatka 2015).

Nonetheless, league tables are important drivers of behaviour for institutional leaders (Hazelkorn 2008; Dobson et al. 2010) and it is certainly the case that students are expressing demands for universities to take sustainability seriously. The National Union of Students (NUS) in the UK has conducted a series of six surveys (e.g. Drayson et al. 2014 and NUS 2016), which consistently reveal that students want to learn more about sustainability and want their institutions to take sustainability seriously. The most recent data indicate that 87% of respondents feel that 'sustainable development is something universities and colleges should actively incorporate and promote' and 61% would like to learn more about sustainable development (NUS, 2016 p. 2). Student demand is having knock-on effects on universities'

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[1] http://peopleandplanet.org/university-league
[2] https://stars.aashe.org/
[3] http://greenmetric.ui.ac.id/

marketing strategies and Bessant et al. (2015) identify a number of UK universities which are explicitly offering sustainability-related courses to all students to enhance recruitment and employability.

There is, perhaps unsurprisingly, significant criticism of ranking methodologies and principles. The choice of indicators as proxies, weightings given to them, and comparability of complex institutions with diverse missions are all issues which undermine many university league tables (Bowden 2000; Hazelkorn 2008), and this includes sustainability rankings. An uncertainty about what sustainability means, and a proliferation of definitions (Reid and Petocz 2006) makes this an especially problematic area for measurement and comparison. Whilst such league tables have been seen by many as supporting moves to a more sustainable HE sector, warnings have also been issued about the People and Planet ranking, even from those institutions most successful under the scheme:

> The danger of such awards is in giving the sense that, first there is a final end
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> point or state, and second, that it has been achieved, and therefore there is little
>
> more to be done … (Sterling et al. 2013, 41)

Other concerns about the Green League have been raised, most recently by Jones (2015), suggesting that successful performers in this league might be pursuing short term 'technical carbon fixes' at the expense of longer term, more holistic approaches to sustainability. Furthermore, the use of league tables indicates a focusing of attention upon measurable criteria which may or may not achieve the desired outcomes:

> The brave new world of university sustainability league tables represent part of a
>
> contemporary zeitgeist of what cannot be counted does no longer have value;
>
> what cannot be tabulated does not have merit. (Jones 2015, 4)

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Such critiques are similar to those applied to all league tables, and indeed other competitive processes such as research evaluation. Arguably, however, the use of league tables for sustainability is particularly ironic, since this approach suggests alignment with the neoliberal agenda of competitive ranking of universities which is the antithesis of a sustainability value-set. Nonetheless, use of metrics in HE is increasing, and sustainability league tables may provoke some movement towards a more environmentally-sustainable university system.

> A sustainable university is viewed as being one which:
>
> Embodies, critically explores and lives sustainability, rather than seeking to deliver it in various discrete curricula or research programmes without reference to its own ethos, practices and operation. (Sterling et al. 2013, 7)

Thus sustainability should permeate all activities of the university – campus, curriculum and research – and it might be expected that sustainability would be visible to students at successful institutions, that it might impact on their subsequent outlook and future careers, or at least on their perceptions of their university's commitment to sustainability. One of the clearest ways in which this holistic embodiment of sustainability is made manifest in universities is through energy conservation and management. In a sustainable university, this issue cross-cuts curriculum, research and campus, and as well as being central to the 'Green League' rankings methodology (see figure 1), it is one of the key areas of focus identified by students when asked to describe sustainability features of their institution (Winter and Cotton, 2012). In the introduction to the '*Handbook of Sustainability Literacy*' Stibbe (2009, p.9) described key threats as including climate change, peak oil, resource depletion, economic uncertainty and energy insecurity, noting the centrality of energy issues to the sustainability agenda.

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[Figure 1 near here]

There is some evidence that participation in HE, regardless of institution chosen, can have a positive impact on commitment to environmental sustainability when other factors are held constant:

> The empirical data presented here are consistent with the view that HE might promote commitment to environmental sustainability through the combination of delivering enhanced knowledge, developing cognitive skills, offering a campus environment within which to exhibit pro-environmental behaviour, and offering a social environment ideally suited to the development of ideological commitment. (Cotton and Alcock 2013, 1468).

However, there is almost no empirical evidence about whether studying at a top ranking 'sustainability university' impacts on students' knowledge, attitudes or behaviours. Shephard et al. (2015) outline the many complexities involved in such an undertaking but suggest that it is worthwhile especially for universities who claim or intend to have an effect in this area. The impact of universities on students' sustainability has been a noted concern in the literature for some time: Hopkinson *et al.* (2008, 439) reported that '…the student experience at most universities typically has a limited and fragmented connection to the values, ideals and practical aspects of living, studying or working in a sustainable way'. Butt *et al.* (2014) cast doubt on the enthusiasm of students for engaging with sustainability initiatives; however, this research is based on websites and staff accounts of student involvement in sustainability rather than data collected from students. In contrast, Drayson's (2015) study indicates that students not only have a significant interest in sustainability, but that they become increasingly interested in such issues as they progress through university.

This research explores the perspectives of students studying at five UK institutions placed at different positions in the Green League (2013)[4] in order to identify any differences in relation to their university's ranking. Although we cannot presume causality, the indications from previous research are that: a) students are not heavily influenced by sustainability issues in their choice of university, and that b) participating in HE can increase students' commitment to environmental sustainability in general. Thus this research seeks evidence which might indicate whether being a student at a 'sustainable university' impacts on engagement with, and understanding of, energy issues – usually some of the most visible manifestations of sustainability in universities - as well as considering some of their broader environmental attitudes.

Energy issues have become a major concern for university leaders in the light of the need for climate change mitigation (Suwartha and Sari 2013). Carbon reduction is a key issue for the Green League co-ordinators: The methodology includes 'Carbon management', 'Energy sources' and 'Carbon reduction' as separate sections, and energy is also included within other parts of the scoring system. (A summary is given in Figure 1). Whilst several different frameworks for energy literacy exist, in this research it is defined as comprising knowledge, attitudes and behaviours (DeWaters and Powers, 2011). DeWaters and Powers (2011: 1699) describe energy literacy as something which:

> … encompasses broad content knowledge as well as affective and behavioural characteristics, will empower people to make appropriate energy-related choices and embrace changes in the way we harness and consume energy.

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[4] https://old.peopleandplanet.org/green-league-2013/tables

The affective and behavioural dimensions of energy literacy are especially pertinent in the light of other research which suggests that knowledge about sustainability issues (the more cognitive and skills focus proposed by Stibbe (2009) and others) may have less impact on subsequent lifestyle choices than attitudes and values (Blake 1999; Kollmuss and Agyeman 2002). Overlaps clearly exist between the various domains; however, all are considered to play an important role in a holistic understanding of energy literacy.

This study explores the question of whether there are any differences in student responses to the survey at universities which are more highly placed in the league table compared to those that perform less well in this ranking. Using energy literacy as a proxy measure for sustainability literacy (but also including the New Ecological Paradigm scale (NEP) (Dunlap et al. 2000) for a wider evaluation of students' environmental attitudes), we compare findings from five institutions, and draw preliminary conclusions about whether there is a relationship between institutional commitment to sustainability and students' energy literacy, wider world-views, or perceptions of their institution. **Research aims**

The aim of this research was to undertake a critical investigation of students' awareness of, and engagement with, energy issues in five HE contexts. As well as exploring their knowledge, attitudes and behavioural intentions, we were interested in investigating the impact of the institutional environment in which students are situated, to seek evidence about whether those in universities with a greater commitment to sustainability had different perspectives to those in universities with less overt commitment. We used the UK Green League as a proxy for institutional commitment to sustainability, and explored the following null hypotheses:

H1: There are no significant differences between scores on knowledge of energy-related issues between students from different universities which relate to their position in the Green League.

H2: There are no significant differences in environmental attitudes of students from different universities which relate to their position in the Green League.

H3: There are no significant differences in self-reported energy-related behaviours of students from different universities which relate to their position in the Green League.

H4: There are no significant differences in students' perceptions of their university's actions on energy saving between different universities which relate to their position in the Green League.

These hypotheses aimed to explore the potential impact of studying in a 'sustainable university'. Arguably, those universities at the upper end of a sustainability league table are as close as we currently get to this ideal although, as noted above, there is a paucity of evidence about differences between students who select these types of institution. This research cannot easily separate recruitment variables from the impacts of university activities, however it is an initial attempt to explore differences between institutions which focus strongly on sustainability and those who do not.

Methodology

Data were collected using a self-administered questionnaire focusing primarily on energy literacy, distributed to the entire on-campus student population at five English universities, each in a different position in the Green League. Distribution of the questionnaire was achieved through an email from departmental administrators including a link to the online survey, hosted by 'Survey Monkey'. The questionnaire consisted of 40 open and closed-

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ended questions, building on prior research to explore knowledge, attitudes and behaviour with respect to energy issues. It included questions from previous surveys on energy targeted at the education sector or the wider population (Holden and Barrow 1984; Holmes 1978; Curry et al. 2005; Poortinga et al. 2006; DeWaters 2009; Brewer et al. 2011; Dwyer 2011; Bodzin 2012; Du Plessis et al. 2012). In addition to the 40 questions, the revised NEP scale was included as a means of exploring respondents' wider environmental attitudes and to enable comparisons with other surveys utilising this scale (Dunlap et al. 2000; see also Lundmark (2007) for critical discussion of the NEP). In order to reduce participation bias related to knowledgeability or enthusiasm for sustainability, a prize draw was offered for participants with an iPod Touch as a prize.

Hypothesis 1 was explored by analysing the proportion of correct answers to the five multiple-choice factual questions below:

- Most of the renewable energy in the UK comes from which of the following sources?

- What does it mean if an energy power plant is 35% energy efficient?

- The term 'renewable energy resources' means …

- Which kind of lighting uses the least amount of energy

  Which of the following actions, if everyone did this all the time, would save the most energy in the UK?

Hypothesis 2 used the NEP to explore differences in wider ecological world-views across the sample and Hypothesis 3 asked students if they undertook any of the following activities with a view to saving energy:

- Turn off lights when they are not in use

- Turn down the heating

- Try to save water

- Walk or cycle short distances instead of going by car

- Buy things that are likely to involve less energy or resource use

- Pay a bit more for environmentally friendly products

- Avoid charging mobile phones overnight

- Turn off the standby button of the TV set or switch appliances off at the plug

- Use rechargeable batteries

Hypothesis 4 was answered by looking at responses to the following questions: 'Is there enough information available on energy use on campus?' and 'Does the university do enough to save energy?' Additional contextual data was gained from a third question: 'Would it make a difference to your behaviour if you could see how much energy is being used around the campus?'

The make-up of the sample, including gender and response rates, is described in Table 1. For ethical reasons, the universities remain anonymous; however, to increase comparability all were institutions with at least 15,000 students, offering a full range of undergraduate and postgraduate courses and with at least some residential students (an important element since the Green League includes 'Initiatives to increase energy saving behaviour of all students in halls of residence'). Four of the five institutions were 'old universities' (established before 1992); the other a 'post-1992' university (one which gained university status in 1992 after having operated as a polytechnic until this date).

The selected universities had very varied positions in the Green League, and their order in terms of final outcomes broadly reflected their scores in the relevant sub-elements

(e.g. 'staff and student engagement' and 'sustainability education and learning'). Gondor scored worst in 'sustainability education and learning' and Mirkwood scored worst on 'staff and student engagement'. For comparative purposes, table 1 provides each university's position in the 'Complete University Guide' (a generic league table) in the same year as the Green League results were obtained. In terms of mission group, three of the universities were in the Russell Group, one in the University Alliance, and one was a non-aligned university.

All samples were predominantly female – somewhat more so than the gender balance of the universities as a whole - and there was a particularly strong female bias at Shire University (See Table 1). The vast majority (70-80%) were 25 or under in all universities. There were some differences in the discipline mix of the respondents represented in each university (see Figure 2). To ensure that these differences did not impact on findings, gender and discipline were controlled for in the analysis.

[Table 1 near here]

[Figure 2 near here]

Data were analysed using SPSS 23.0 (Statistical Package for Social Sciences). Descriptive analysis was undertaken (frequencies, cross tabulations and central tendency statistics), together with ANOVA and Discriminant tests.

Findings

H1: There are no significant differences between scores on knowledge of energy-related issues between students from different universities which relate to their position in the Green League.

In order to test this hypothesis, it was necessary to control for the effects of gender and discipline which varied in the different institutions. Respondents were asked to answer five

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multiple-choice factual questions about energy, achieving a mean score of 3.11 out of 5

(standard deviation 1.1) across the whole sample.

[Table 2 near here]

Students at Gondor University provided the highest number of correct answers, and students

at Shire the lowest, although differences were slight. In order to explore the impact of gender

and discipline mix as well as any impact of studying at a particular institution, a three-way

ANOVA approach was used.

The analysis identified significant effects of gender on knowledge scores ($F_{(1, 3649)}$

$= 36.91$, $p<.0005$), with male students scoring more highly irrespective of institution. This

replicates the findings from the pilot study, where gender differences in both self-reported

and actual knowledge were found (Cotton et al. 2015). Significant effects of discipline were

also found ($F_{(3, 3649)} = 13.51$, $p<.0005$), irrespective of gender and university, with

Hochberg post-hoc tests revealing that Science and Technology performed significantly

better than Health and Medicine ($p<.0005$), Arts and Humanities ($p<.0005$) and Social

Sciences ($p<.0005$). Analysis of knowledge scores for students from different institutions

shows a significant interaction between university and gender ($F_{(4, 3649)} = 4.40$, $p= .002$).

Thus gender differences in performance are significantly different in distinct Universities:

male students at Gondor and Shire perform significantly better than those at Rivendall,

Mirkwood and Dale, but female students from Rivendall, Dale and Gondor perform

significantly better than those at Mirkwood and Shire (see Figure 3).

[Figure 3 near here]

In summary, while there are differences in knowledge scores between students of

different genders and from different universities, these could be attributed to variance in prior

sources of knowledge, or to different entry tariffs, but are not related to the university's position in the Green League, and the null hypothesis must be accepted.

H2: There are no significant differences in environmental attitudes of students from different universities which relate to their position in the Green League.

In relation to this hypothesis, the revised NEP scale (comprising 15 Likert-style statements) was used to give an indication of students' environmental attitudes and underlying world-views which help shape actions towards the environment. This 5 point scale (on which lower scores indicate more pro-ecological world-views)[5] was used to allow comparison with other research. The mean score across all five universities was 2.43 (standard deviation 0.49) suggesting that the respondents were relatively pro-ecological across the sample.

However, a potential gender/ discipline interaction was again anticipated; thus a three-way ANOVA was utilised to test the interactions between gender, discipline and university. The analysis identified significant effects of gender on NEP scores ($F (1, 3584) = 33.18$, $p<.0005$), with female students generally having more pro-ecological world-views. There were significant differences in NEP scores across disciplines, irrespective of gender and University, with Hochberg post-hoc tests revealing that Health and Medicine students were significantly more pro-ecological than Social Sciences students ($p=.006$). However, there were also significant differences in the ecological worldviews of students in different universities, irrespective of gender and discipline, with Hochberg post-hoc tests revealing that Shire student respondents had significantly more ecological world-views than Rivendell

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[5] Some caution is needed when interpreting NEP scores, partly because of the subjectivity in determining 'mean' environmental worldviews and partly because the aggregation required to produce overall NEP scores can be variable between different authors (such that the meaning of a low NEP score differs).

(p<.0005), Dale (p< .0005), Gondor (p=.078), Mirkwood (p=.006) after having controlled for gender and discipline. This appears to result from the male students at this university having lower (more pro-ecological) NEP scores than elsewhere: Although female students are more pro-ecological than males in all universities, the difference is least at Shire (see figure 4). So, in this case the null hypothesis is rejected: There are differences between institutions and this is – to some extent – related to their ranking, in that the university with the highest Green League position also has the students with the most pro-ecological world-views.

[Figure 4 near here]

H3: There are no significant differences in self-reported energy-related behaviours of students from different universities which relate to their position in the Green League.

Since this research was based on a survey, it is not possible to get a direct measure of student behaviours, hence reported behaviours were used as a proxy – with all the limitations that this incurs. However, in terms of comparison, there is no reason to anticipate that students in any particular university are likely to be more or less accurate than those in the others. Nine questions about potential energy-saving behaviours were used (as listed earlier), measured on a four-point scale (Always; Frequently; Infrequently; Never). For the purposes of analysis, the dependent variable was formed by combining students' responses about their likelihood of undertaking each of these actions. Low scores indicate a higher likelihood of saving energy.

A three-way ANOVA was again used, finding few significant differences. Behavioural responses from students across the different universities were remarkably consistent – with a preference amongst most respondents for low-cost, low-effort behaviours such as turning off lights. Significant interactions were found between university and

discipline (F (12, 3696) = 1.59, p= .087), indicating that students in different disciplines reported somewhat different levels of energy-saving behaviours in the different universities. Thus, Science & Technology students reported more energy-saving behaviour in Shire and Rivendell, Health & Medicine students more energy-saving behaviour in Dale and Gondor and Arts & Humanities students more energy-saving behaviour in Mirkwood. Similarly, a significant interaction was found between gender and discipline (F (3, 3696) = 2.04, p= .069), with female students in Science & Technology exhibiting more energy-saving behaviour than males; while male students in Health & Medicine, Arts & Humanities and Social Sciences reported more energy-saving behaviour than females. In terms of the hypothesis, the null hypothesis can be accepted since there are only small differences in self-reported behaviour and there is no correlation between reported energy-saving behaviours and position in the Green League.

H4: There are no significant differences in students' perceptions of their university's actions on energy saving between different universities which relate to their position in the Green League.

Another section of the survey asked students questions about their own institution and its energy-saving and communication efforts. They were also asked if it would make a difference to their behaviour if they could see how much energy was being used. These were all yes/ no answers, with the addition of a 'don't know' option for 'Does the university do enough to save energy?' as it was felt that students might genuinely not know what their university was doing in this sphere. These questions cover several aspects, as responses will encompass both how much information the university provides and also whether the students are interested enough and care enough to want to know more. Universities which have been successful in the Green League have been criticised by some for failure to communicate

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effectively with their students (Jones 2015). These questions directly address the issue of whether the perceptions of students about their university's activities are consistent with its ranking. Chi Square tests were used.

[Table 3 near here]

With regard to whether there was enough energy information on campus, it can be seen that Shire students gave the highest percentage of affirmative responses, and Mirkwood the lowest. There is a clear significant association between perceptions of information availability on campus and position in the Green League ($\chi^2(4) = 28.64$, p< .0005), as illustrated in Figure 5, although it is notable that most students said there was not enough information available (in all universities).

[Figure 5 near here]

A very large proportion of students (70% and upwards at all universities) answered positively to the question, 'Would it make a difference to your behaviour if you could see how much energy is being used around the campus?' which suggests that provision of information to students could be an important mediating factor in on-campus energy-saving. Responding to the question about whether their institution was doing enough to save energy, the pattern is somewhat less clear (see Figure 6) but there remains a significant relationship between university and student response ($\chi^2(8) = 208.71$, p< .0005). Shire students are again the most positive, and Shire was the only university where the number of students agreeing outweighed the number who disagreed.

[Figure 6 near here]

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It is therefore possible to reject H4 as there are significant differences in students' perceptions of their university's actions on energy saving between different universities which relate closely to their position in the Green League.

Discussion

There is widespread agreement amongst students, universities and employers of the need for sustainability education. Students exhibit growing enthusiasm for learning about sustainability in HE; universities sign up in ever increasing numbers to the Talloires Declaration; and employers bemoan the difficulty of recruiting graduates with the skills needed to embed sustainability into business settings (Drayson 2015; World Environment Centre 2011). However, whilst many universities express an interest in sustainability, variations in how seriously this is operationalised (in terms of high-level support, buy-in and resources allocated) in each institutional context may influence the effectiveness of attempted changes.

As far as we can measure such things, those universities at the top of the sustainability ranking should be considered as exemplars of the 'sustainable university' (Sterling et al. 2013). The higher-ranked institutions have provided evidence of sustainability embedded in both curriculum and campus operations which might be expected to impact on the student experience (and thus potentially on their knowledge of and attitudes/behaviours with regard to energy). We would argue that energy literacy should offer a good proxy for wider sustainability issues as measured by the Green League, since energy contributes strongly to the metrics used. The issue of energy conservation and management cross-cuts curriculum, research and facilities management areas in exactly the way that Sterling et al. (2013) describe a sustainable university functioning, and it is one of the key areas of focus identified

by students when asked to describe sustainability features of their institution (Winter and Cotton, 2012).

And yet this study reveals relatively few differences between the responses of students at the different universities involved (particularly in terms of whether these related to ranking position). In some ways, this is unsurprising: Sustainability is a complex concept thus any differences are unlikely to be clear-cut or easily detected by proxy measures. On two of the energy-literacy measures, (knowledge and behaviours), differences were slight and not related to institutional ranking. It might be that students are not influenced much by their institution's sustainability credentials, and indeed Butt et al. (2014) argue that engagement with sustainability is mainly from staff rather than students. However, it is also possible that impacts on students of their time at university are longer-term and would not be picked up by our research design. In support of this position, the student surveys by Drayson (2015) demonstrate a stronger impact of university on third year students than on first years. To explore these issues longitudinal research would be necessary.

The similarities in students' reported knowledge and behaviour across the sample suggests that at least a some aspects of energy literacy are formed prior to attending university, and indeed this is supported in the wider literature on young people and sustainability (Asunta 2003). There are also gender differences identified in previous research which mostly suggest that females are more receptive to sustainability (e.g. Zelezny et al. 2000), and other work suggests that children develop sustainability behaviours from a young age through classical and operant conditioning and observational learning (Renton et al. 2011). Subtle discipline differences also emerge in this study, in line with some previous research which identifies a relationship between students' discipline choices and NEP (e.g. Lang 2011; Bergman et al 2014). However, both this and our previous research on energy

literacy (Cotton et al., 2015) have found a less than clear relationship between discipline and energy literacy. Further exploration of these issues would be of interest.

Using the NEP measure of ecological world-view, the top ranked institution was significantly different from the others even once gender and discipline were controlled for. Given previous research which suggests that the act of studying in HE can influence students' attitudes towards environmental sustainability (Cotton and Alcock 2013), this finding may provide cautious optimism that a 'sustainable university' can strengthen this response in its students. The difference in student world-views at this institution could be the result of the substantial sustainability activities in which it is engaged, suggesting that a significant impact on students can be achieved at least at the extreme end of the ranking. Of course, this finding may simply reflect a tendency for students to select an institution which aligns with their pre-existing world views. However, Drayson's (2015) research found very little evidence that students were selecting universities based on their sustainability principles, and Arnon et al.'s (2015) research on a sustainability-focused institution also found this a 'not very significant factor' in student choice (p.1042). Drayson's report noted that 'How seriously the college/ university takes environmental issues' was consistently ranked as of lowest importance of the factors which might influence student choice, with prospective students being influenced primarily by core metrics and reputational elements as well as location.

The clearest evidence of the effectiveness of universities' sustainability activities on their student cohorts comes from the final questions about energy information on campus and awareness of energy-saving activities. This suggests not only that universities who are performing highly on this sustainability ranking are more effective in energy-saving – which fits with the Green League criteria – but that they are more effectively communicating this with their students. (Albeit that the students at these institutions may also be more interested

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in receiving such communication.) These findings are suggestive in terms of the ways in which higher ranked universities might be making a difference to students in a subtle way. Differences in students' perceptions of energy-saving information on campus and the university's activities align quite clearly with position in the ranking, and are indicative of more visible and effective communication around energy issues in higher ranked institutions.

Given that the students at Shire University (our top ranked institution) had more pro-ecological worldviews, you would expect them to be more critical of the university's energy-saving actions, and yet they are most positive. This challenges Jones' (2015) assertion that universities who are successful in the Green League fail to communicate or conduct effective dialogue with students. Even a small increase in student awareness is of potential importance since research on the hidden curriculum suggests that making students aware of sustainability issues is a first step towards enhancing their knowledge and understanding (Winter and Cotton 2012). Steg and Vlek (2009) also note the importance of awareness as a pre-cursor to behaviour change. The indication by respondents that they would be more likely to change their behaviour if they had a visible representation of energy usage is interesting since some of the universities in the sample were working on energy visualisations targeted at students. This suggests that there may be potential for student behaviours to be influenced longer term.

There are clearly some limitations to the Green League which may have an impact on the findings of this research. As in all rankings, proxy measures are used which may or may not provide good indicators of the level of commitment to sustainability (for example policies and committees etc). Concerns about the Green League include the significant time required to complete the detailed survey which underpins the ranking, the timing of its distribution (over the summer break when staffing may be at its lowest), and more specific issues such as the difficulty of energy conservation in some of the ancient universities whose buildings were

not designed with this in mind (Bawden, 2015). In addition, the extra-curricular sphere is given relatively little attention in the Green League, yet it is known to be a preferred mode for students to engage with sustainability (Drayson 2015). Boycotting of the league table by an increasing proportion of universities means that over time the ranking has become increasingly dependent upon freely available data sets (although this may in turn, reduce 'gaming' by institutions who seek to maximise their position). Clearly, there is more work to be done on developing effective indicators for HE that take into account the potential for universities not just to reduce carbon and recycle paper – but to engage students effectively as future decision-makers in sustainability issues.

There are some limitations of our research design which may mean that differences between the universities failed to emerge. The first issue is the relatively small number of institutions in the study, which makes it difficult to correlate Green League position with other variables. A second is that, although the sample size overall is good, the response rate in each institution is relatively low – as online surveys of students often are. It is possible that the lack of differentiation between universities is simply because the students who responded to the survey have more in common than those who did not respond. And finally, the study does not include a direct behavioural measure, relying instead on reported energy-saving behaviours. However, these latter two issues affect all institutions in the sample, thus comparability is retained.

There remains a need for longitudinal research to make an accurate assessment of the 'value-added' element of student sustainability, which takes into account students' existing perspectives when they start in HE (as suggested and initiated by Shephard et al., 2015) and a greater focus on sustainability as part of the wider student experience. Future research might look more explicitly at communications related to energy (for example, visual displays/

dashboards, web-site information, and targeted emails or other communications). Finally, from an institutional perspective, it would be useful to know more about whether the students' enhanced perceptions of their university's actions on sustainability in the higher ranked universities translated into feeling more positive about other aspects of the student experience, as this might provide an additional motivation for universities to engage in sustainability activities.

Conclusions

The question of whether a university's place in a sustainability ranking impacts on the students at that institution is complex and cannot be conclusively resolved without undertaking the kind of experimental research which would be impossible in practice. The title of this paper asks whether students' energy literacy is related to their university's position in a sustainability ranking, and this research suggests that there is not a simple link between the two. However, it does provide some evidence of consistent differences between student perspectives at universities which are placed at different points in the UK Green League, and thus by implication suggests that the university may impact on its students. Differences are more evident in terms of general environmental attitudes than either energy-related knowledge or behavioural intentions, perhaps because these are measuring very specific constructs. The findings also suggest that the higher ranked universities may be better at communicating their activities to students, and that their students are generally more positive about their university's sustainability activities, at least in relation to energy issues. The research indicates that students are more likely to choose energy-conservation behaviours if they can see how much energy is being used around campus. This may explain the success of the universities which are placed higher in the ranking. Whilst this research clearly has a number of limitations – not least the use of the Green League as a proxy for a

sustainable university, and the lack of a direct behavioural measure – it is one of relatively

few studies which have attempted to measure the impact on students of universities' efforts

towards educating for a sustainable future.

Figure 1: Green League Methodology

1.   Environmental Policy worth 4 %

2.   Human Resources worth 8.5%

3.   Environmental Audits and EMS worth 10%

4.   Ethical Investment worth 7%

5.   Carbon Management worth 7%

6.   Workers Rights worth 5%

7.   Sustainable Food worth 4.5%

8.   Staff and Student Engagement worth 5%

9.   Education worth 10%

10.   Energy Sources worth 8%

11.   Waste and Recycling worth 8%

12.   Carbon Reduction worth 15%

13.   Water Reduction worth 8%

(People and Planet, 2014)

Table 1: Sample, response rate and demographics

University (pseudonym)	Green League position 2013	Complete University Guide position 2013 (rank within sample)	Response rate (N)	Gender balance in sample (and whole population) F:M	Age	%
Shire	1-19	50-100 (5)	2.9% (N=771)	70:30 (56:44)	20 or under	40.4
					21-25	34.8
					over 25	24.8
Rivendell	20-39	1-50 (1)	14.9% (N=1793)	58:42 (53:47)	20 or under	47
					21-25	34.6
					over 25	18.3
Dale	40-69	1-50 (3)	3.8% (N=1175)	58:42 (55:45)	20 or under	42.1
					21-25	38.8
					over 25	19.1
Gondor	70-89	1-50 (2)	0.8% (N=183)	60:40 (53:47)	20 or under	35.1
					21-25	51.3
					over 25	13.6
Mirkwood	90-110	50-100 (4)	2.1%	58:42	20 or	34.9

27			(N=497)	(56:44)	under	
					21-25	34.7
					over 25	30.4

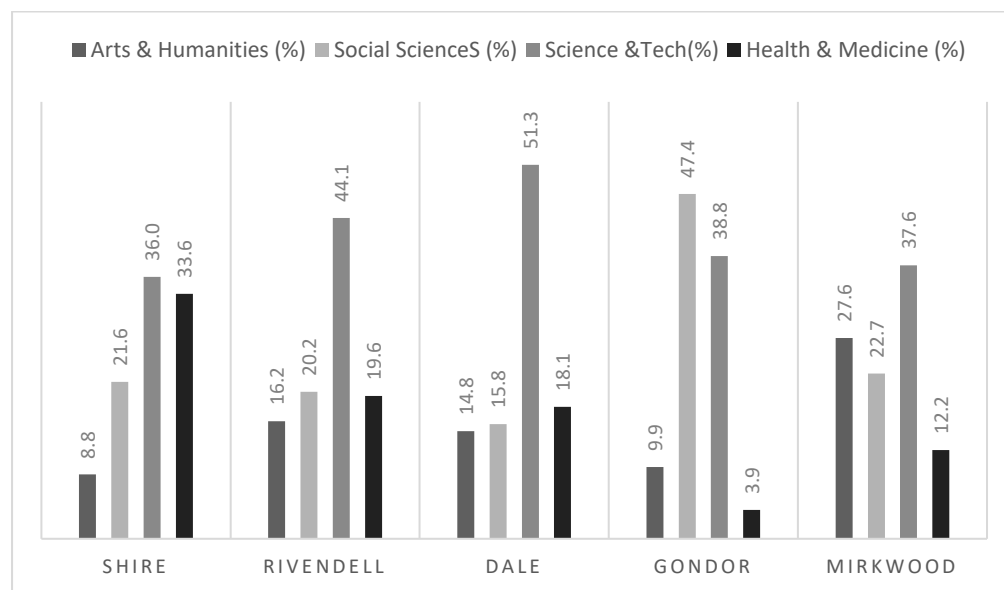Figure 2: Discipline mix of respondents at the different institutions

Table 2: Mean knowledge scores of students at the different institutions

University	Mean number of correct answers	Standard deviation
Shire University	2.92	1.130
Rivendell University	3.18	1.067
Dale University	3.17	1.102
Gondor University	3.24	1.044
Mirkwood University	2.98	1.101

Figure 3. Mean plot showing interaction effect of University x Gender in the three-way

ANOVA model identifying variations of knowledge.
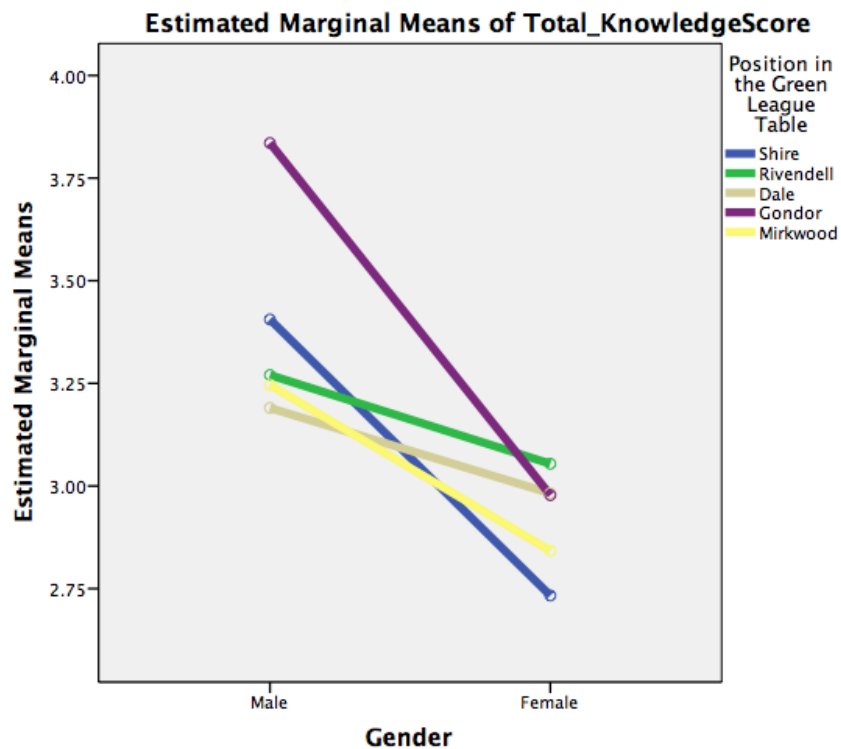
Figure 4. Mean plot showing interaction effect of University x Gender in the three-way

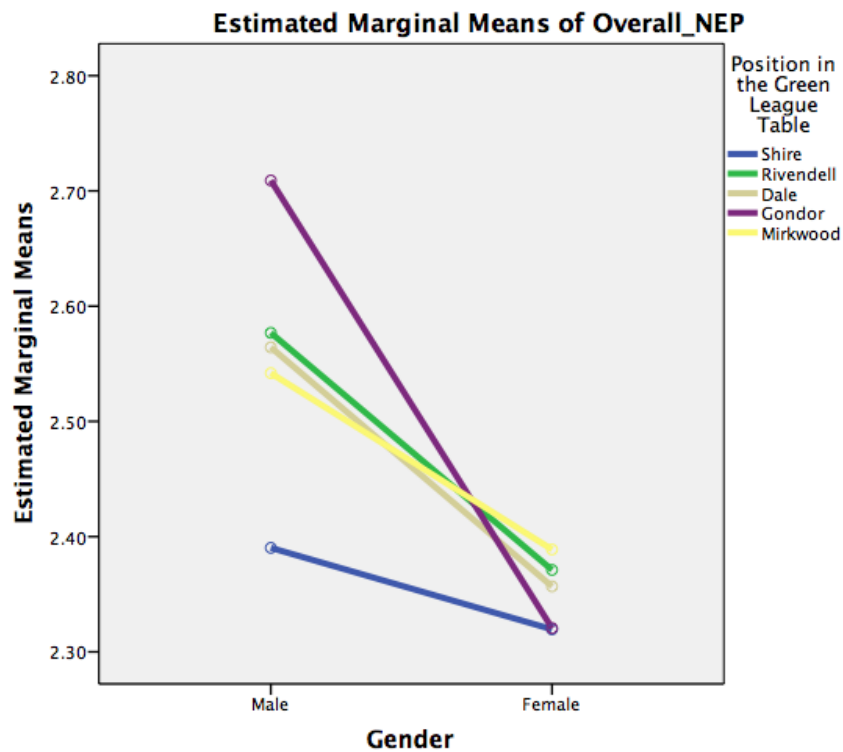ANOVA model identifying variations of ecological worldviews.

Table 3. Environmental practices at the university – students' perceptions

	Answer	Shire	Rivendell	Dale	Gondor	Mirkwood
Is there enough information available on energy use on campus?	YES	33.0%	30.5%	30.5%	26.60%	19.60%
	NO	67.0%	69.5%	69.5%	73.40%	80.40%
Does the university do enough to save energy?	YES	31.9%	12.9%	24.2%	15.5%	10.9%
	NO	24.7%	38.3%	26.6%	48.9%	31.9%
	DON'T KNOW	43.4%	48.8%	49.2%	35.6%	57.2%

Figure 5: Is there enough information about energy use on campus? (Percentage of

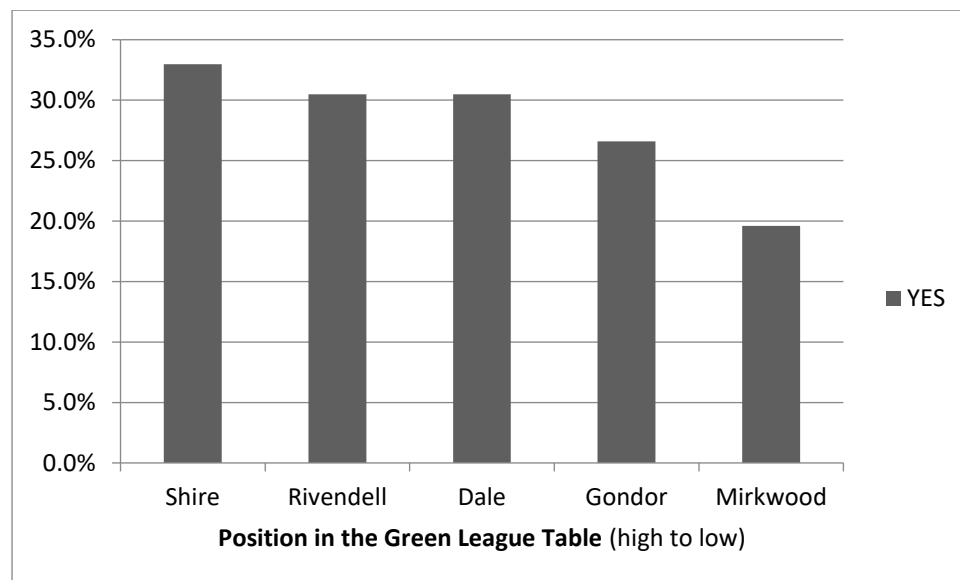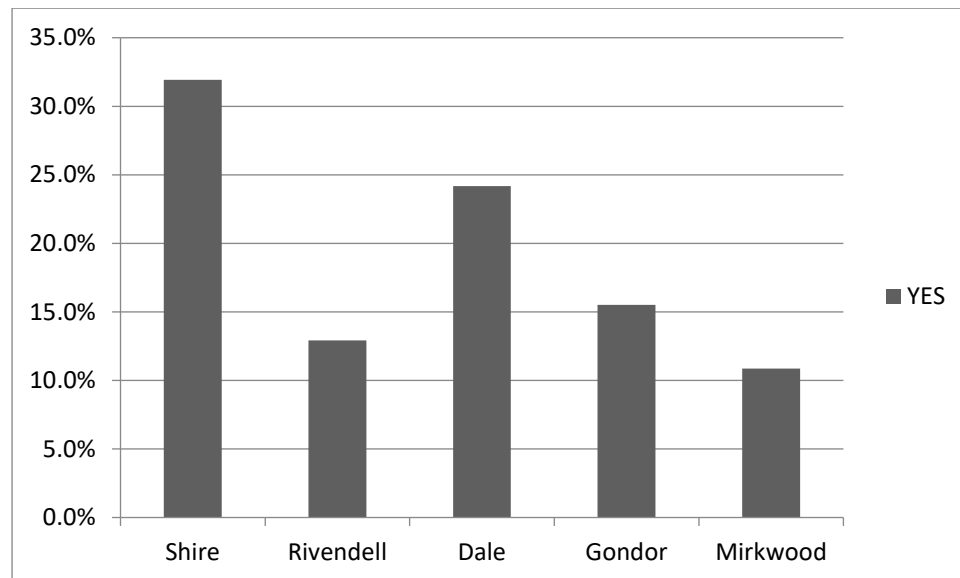respondents who answered 'Yes')

Figure 6: Does your university do enough to save energy? (Percentage of respondents who answered 'Yes')

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