



Interactive comment on “Hydroinformatics education – The Water Informatics in Science and Engineering (WISE) Centre for Doctoral Training” by Thorsten Wagener et al.

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RESPONSE TO REVIEWER 2

General Comments:

Wagener et al. are introducing the doctoral training program WISE running for now 7 years between the Universities of Bath, Bristol, Cardiff and Exeter. They motivate their approach, differing in several well described aspects from the standard 3-year doctoral training, by the need to improve the coding skills of trained water practitioners and scientists to handle the many new data and sensor challenges of the 21st century. They

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argue that neither a pure water scientist nor a pure computer scientist is fit for the challenges ahead and that their interdisciplinary approach bridges this gap while providing a fruitful and supportive environment for PhD candidates. The paper is well written, well-structured and easy to read. I fully support sharing outcomes and experiences from new doctoral training approaches to hopefully foster a community learning effect in adapting the often ancient mechanisms of doctoral training. While I fully appreciate the goal to spread the ideas implemented in the WISE CDT program to potentially inspire other educators, I would wish for the paper to advance from the description of the way the program is working to also offering a bit of general advice and some lessons learned.

RESPONSE: We thank the reviewer for the positive assessment of our manuscript and for the encouragement to further discuss the wider experiences gained with our WISE CDT. We will be happy to do so and provide some suggestions about how we might do this in our answers below.

Specific Comments:

The last section is named “Conclusions and Lessons Learned”. While I can identify the “Why”, “What” and outcome I am missing the section on “Lessons Learned”. Also, the abstract states that “We conclude with an outlook for PhD training”. I would appreciate if the authors could indeed give such an outlook and mention some lessons learned. Please clearly state and condense what in your experience/your surveys identified as helpful and beneficial to the PhD program and should potentially be incorporated in future PhD trainings.

RESPONSE: We agree with the reviewer that we insufficiently discuss our transferrable learning in the current manuscript. We will adjust this section to include a generalization of what we thought worked well and worked less well.

On a similar note - is there a chance to use the ideas of the WISE CDT also for smaller groups/ doctoral programs? What are the “must haves” of modern doctoral training

(according to your experience/surveys) that can even be implemented in individual supervising?

RESPONSE: Yes, there are some ideas and some lessons learned that will also be useful for smaller programs. The ideas of “must haves” is great and we will use it. We, for example, believe that doctoral programs without coordinated training elements (as still the norm in some countries) places students in a disadvantage. This might not be true for the exceptional student, but most students will strongly benefit from wider training.

The paper currently highlights the positive and well working aspects of the program. But I am sure there must have been several challenges along the way. For the initiators and supervisors as well as for the students. Could you please elaborate on the difficulties and challenges of the process and how they were solved (as already partly described in line 269)?

RESPONSE: Yes, the reviewer is absolutely right. Sharing our challenges will be equally helpful to others as will be sharing our positives. We will add main challenges we faced that relate to the program itself. Of course, with over 80 PhD students, there were occasional individual challenges for students or for student-supervisor relations. Such irregular issues were no different from what would be encountered in any reasonably large PhD candidate population. In the revised manuscript we will discuss the following program challenges (and how we dealt with them):

- Managing a PhD programme as a partnership of 4 universities (given that differences between the universities’ approaches are a common “area for improvement” for student requests).
- Creating the PG School programme to meet the needs of students with very different academic backgrounds. Students entering the WISE CDT have very heterogeneous backgrounds (engineering, science . . .), which means we regularly had courses where some students struggled (and got stressed) while others were not challenged. This became more difficult after a few years into the program because we had to take out optional modules and make all first-year modules compulsory (due to a change in

teaching structure at the University of Exeter that was out of our control). On the positive side it also meant that students could help each other very well, which added to the cohort feeling. A key positive element for all students was the cohort experience in year one. Studying as a group rather than as individual PhD candidates was a positive aspect of WISE for everybody. It became difficult to continue this cohort experience once the PhD candidates moved to their home institution at the end of year 1. We tried a range of things to keep this going, which we will discuss. Managing student visits to international organisations that all have their own administrative and financial requirements created some headaches, though all students went to their chosen destination – until the pandemic started. Another aspect might be that students not part of WISE might experience less favourable conditions, such as significantly less travel funds. Though there have been no open complaints about this and we tried – when possible – to have other students benefit from WISE activities, e.g. by joining transferrable skills workshops. Of course, the programme and our students have also inevitably been impacted by the Coronavirus pandemic. Adaptations have been made to ensure the continuation of the training programme and research projects. We will address this in detail in our revision of the manuscript.

Regarding the student experience, I was wondering in 3.1. “Student Participation and Feedback” if there were also less favorable comments in the student surveys. E.g. that students feel lots of pressure, suffer from a high workload or similar? If so, what percentage of the total answers were less favorable? And what was the focus of their concern?

RESPONSE: We will expand on this issue with the following information. Our most comprehensive survey is the Student Experience Survey, which we ask each PhD candidate to complete on conclusion of their programme. This survey asks students to rate their experience of the CDT and seeks their feedback on both positive and negative aspects, plus areas for improvement. We have found that students are able to realistically reflect on their entire CDT experience at that stage (once the final examination stress

is over). To date we have a complete return for Cohort 1 and a partial return for Cohort 2. The survey asks students to rate their overall CDT experience plus diverse elements of the programme using a scale from 1-5 (from “very poor” to “excellent”). Cohort 1 students rated the CDT experience overall as “good”, with a mean score of 4.25 out of 5. Cohort 2 respondents to date have scored it 4.5 out of 5. Most frequently mentioned by both cohorts as the best elements are the cohort experience, the funded research visit (up to 3 months abroad), and the opportunity throughout the programme to present work and engage with other researchers. For our complete Cohort 1 return, the most frequently cited areas for improvement were: 1st – Re-think the postgraduate school (which was actioned – we went from 6 compulsory and 2 optional modules to 8 compulsory modules due to University wide changes; we also went from long and thin modules – over a full semester, to short and thick – over a few weeks & we tried to help students who came into the program with less quantitative skills to catch up before the actual program started); 2nd - Unified approach across 4 universities (e.g. registration periods, PhD thesis submission, extension requests) (this is difficult to adjust given that it is largely out of our control); 3rd - More interaction between the 4 universities, both students and academics (e.g. joint supervision, inter-disciplinary events, data/software sharing) (this has developed as WISE grew). The additionally obtained Happiness Index data (limited so far) might suggest lower levels of happiness as students reach the latter stages of their programme and the deadline for PhD thesis submission.

The authors mention different survey results several times. Could you please give a short overview (maybe at the beginning of 3.1.) of the different surveys conducted and specify the scope of those surveys? Is it always the same survey? A yearly ritual? Is it mandatory? What kind of questions are part of the survey? How are the surveys evaluated and used?

RESPONSE: The “Surveys” would cover the following, - End of Year 1: Postgraduate School review meeting – face-to-face feedback to Centre Manager and program Director; - Transferrable Skills and Leadership module evaluation forms; - Annual Progress

Review “Happiness Index”; - End of programme student Experience Survey. Everything is reported to the program management group (directors and co-Is) and discussed there (bi-annually). Data from Happiness Index and Student Experience Surveys are also reported to the external Advisory Board (from Industry (mainly) and Academia). In addition, we informally, we expect student representatives (one per cohort across the four universities) to “survey” their cohort to feed in ideas, comments and criticism to each program management group meeting. Examples of actions taken in response to student feedback: - Enhanced student support/administrative support; - Seeking Chartered Institution of Water and Environmental Management (CIWEM) accreditation to meet the needs of students without a formal engineering background; - Amendments to content of 1st year Postgraduate School programme; - Enhancements to transferable skills modules, e.g. viva (PhD exam) preparation, careers guidance; - Broadening the Industry Day focus/guests to cover the breadth of students’ research interests; - Website enhancements – secure library of CDT templates/guidance; - Ongoing engagement with alumni, including in CDT events, e.g. talks to current students; - Involving students in planning of CDT events.

Minor/Technical Comments:

It seems only Fig 1 and Fig 6 are referred to in the text. Please add the other figure references to appropriate positions in the text or consider their necessity.

RESPONSE: That was our oversight. We will refer to them in the text.

Line 19 – shouldn’t this say over 80 candidates as line 375 states 84 students were recruited?

RESPONSE: Yes, the numbers were not quite correct. We will revise with the latest numbers.

Line 22 – this might be 7 years now?

RESPONSE: We will be more specific on the time period.

Line 72 & Line 379 to 406 – are the WISE CDT PhD topics indeed correlating with these ambitious goals? As a reader I would find it helpful to have a short list of example PhD Topics that came out of WISE CDT to assess this myself.

RESPONSE: Adding a list of PhD thesis titles is a good idea. We will add this as supplemental material and also organize them in relation to the program goals.

Line 137 – writing 8 as eight?

RESPONSE: OK.

Line 147 – it would be nice to have a short information in what kind of setting the students were making these comments (probably the/a survey?)

RESPONSE: We will add more information on this to the section. Generally, student feedback is obtained later in their programme or on completion of programme through the Student Experience Survey. This particular quote from James Webber was a reflection of how useful the PG School modules turned out to be as his research developed (which he didn't necessarily think at the time of taking them). Similar for Olivia Bailey. "Setting" would be either asking students individually for their feedback and permission to use as quote or through a formal survey.

Line 195 – After "Water Hackathon" comes a dash which ends with a bracket

RESPONSE: We will delete this.

Line 216 – about the "PhD progress monitoring meeting": Who is assessing the progress?

RESPONSE: There are two levels of progress assessment. First, there is the annual assessment taking place at each university separately. Second, there is an annual assessment of candidate progress as part of the program management team, i.e. the director, co-directors and co-Is of WISE.

Line 244 – What is meant by regular? Once a month? Once a year? Or at least:

What's the aimed for regularity? Same for Line 263.

RESPONSE: This will vary somewhat between individual supervisors and time periods within a candidate's PhD. Typical would be every 1-2 weeks.

Line 355 – The authors describe one specific outreach example, but can there be a short introduction to the outreach ambitions of WISE CDT? Is this a specific goal of WISE? Can any other examples at least be named after or before describing the specific example?

RESPONSE: As typical for UK doctoral programs in engineering, there has been a strong focus on interaction with industry throughout the program. Hence most activities beyond academia were focused on strengthening connections and exchange with industry and industry partners. Outreach activities with the general public have been more ad-hoc. We included this specific example because it was particularly successful (based on the PhD candidates' response). Other outreach examples are (we will include examples like these in the revision): 'Walking with Scientists' – Ioanna Stamatakis (Bath Cohort 1) led a guided walking tour showcasing Bath's rich science history – as part of 'FUTURES 2019'. Ioanna's talk focused on the historical floods of the River Avon and the applications of using this data. 'New Scientist Live 2019 - WISE and STREAM CDTs joined forces under the umbrella of 'EPSRC Water Engineering' to share their research with the public via posters, demonstrations and experiments 'Tomorrow's Engineering Week' 2019. As part of this initiative, Cardiff student Santi Lopez (Cohort 5) volunteered on behalf of ICE Wales to provide 'Engineering Team Challenges' to secondary school students, with the aim of encouraging them to consider a career in engineering. 'TOMORROW': SWINDON'S SCIENCE FESTIVAL. WISE students showcased an Augmented Reality Sandbox, developed by KeckCAVES and supported by the National Science Foundation, which allowed the audience to sculpt miniature sand landscapes and generate 'clouds' and 'rainfall' with their hands. The group also demonstrated the effects of flooding (such as flash flooding from a dam break) and natural disasters (e.g. tsunamis) on different landscapes

and their associated engineering mitigation strategies.

Line 377 – I was wondering if the PhD candidates are provided with sufficient funding when entering the program or if this is a separate issue. Do they get stipends? Does funding get better when collaborating with an industry partner?

RESPONSE: All WISE students are fully with both a stipend and tuition fees for 4 years. All students also have a generous travel budget to be used over the 4-year period for both conference/workshop attendance as well as for an international research visit (~3 months). Potential additional funds from industrial partners get added as travel or research funds. We will add this information to the manuscript.

Line 382 – possibly include reference to Figure 7

RESPONSE: Yes, we will do that.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2020-475>, 2020.