

Training sessions and workshops

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WP4 – Dissemination and Exploitation

Task 4.1: Training Actions and Workshops

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LINKVIT Training Action KU Leuven, February – May 2015

Short Description:

The document is the report of the LINKVIT Training Actions organized by KU Leuven between February 2015 and May 2015.

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1. Introduction

The document is the report of the LINKVIT Training Action organized at KU Leuven between on February and May 2015. The Training Action was integrated in the Master course on 'Spatial Data Infrastructures' (6 ECTS; 52 study hours) taught by prof. dr. Jos Van Orshoven. The course is included in several Master Programs at KU Leuven: Master of Geography, Master of Agro- and Ecosystems Engineering and Master of Bioscience Engineering. The course consists of both lectures (4 ECTS – 26 study hours) and assignments (2 ECT – 26 hours).

This report includes the announcement and description of the training action, the list of participants, the agenda, the proceedings, the outcomes of the course, the follow up and the evaluation of the action.

2. Announcement

The course announcement and description can be found at:
https://onderwijsaanbod.kuleuven.be/syllabi/e/I0U99AE.htm#activetab=doelstellingen_idm4515824

"SDI" is the generic solution to the lack of accessibility and interoperability of geospatial datasets. An SDI is a set of technological and non-technological components meant to facilitate access, exchange and re-use of geospatial data within and between organisations with a view to contributing to the spatial enablement and performance of all kinds of user processes. In this course, SDI is studied as multi-component adaptive systems. Emphasis is given to the management and user perspective on SDI. Through the course students will:

- *Acquire thorough knowledge of the rationale and concepts of Spatial Data Infrastructures (SDI);*
- *Acknowledge the organizational dimension of SDI;*
- *Acquire thorough knowledge of the technical components of SDI: (i) geospatial data repositories, (ii) metadata catalogues, (iii) access services and (iv) technical standards regarding (i), (ii) and (iii);*
- *Learn to interact with SDI to discover, explore and exploit geodatasets;*
- *Work with geospatial databases and SQL;*
- *Learn how to contribute to SDI through data modelling and standardization, metadata compilation, service development*

3. List of Participants

Surname	Name	Organisation
Lijnen	Kobe	Student KU Leuven
De Geest	Pieterjan	Student KU Leuven
Verdoodt	Dries	Student KU Leuven
Peters	Wout	Student KU Leuven
Neujens	Joost	Student KU Leuven
Compère	Adrien	Student KU Leuven
Hage	Fanny	Student KU Leuven
Willemot	Niels	Student KU Leuven
Tooth	Niels	Student KU Leuven
Vanmontfort	Enyo	Student KU Leuven
Van der Borgh	Tessa	Student KU Leuven
Tytgat	Nele	Student KU Leuven
Flasse	Charlotte	Student KU Leuven
Christiansen	Camille Marianne	Student KU Leuven
Nowacki	Tomasz	Student KU Leuven
Leybaert	Vere	Student KU Leuven
Nguyen	Ngoc Thang	Student KU Leuven
Schoors	Willem	Student KU Leuven
Oncu	Zeynep Pinar	Student KU Leuven
Ouellette	William	Student KU Leuven
Fardis	Amir	Student KU Leuven
Pastor Martin	Candela	Student KU Leuven
Van Assche	Jo	Student KU Leuven
Hendrickx	Liane	Student KU Leuven
Debonne	Niels	Student KU Leuven
Rombouts	Bjorn	Student KU Leuven

4. Agenda

Date	Topic	Material
13-feb	From GIS to SDI (1.	Longley Ch11,Ch19
20-feb	The 'data component' of SDI: Geospatial data repositories (2.PPT)	Longley Ch10
27-feb	The 'metadata component' of SDI: Metadata, Metadata catalogues, data quality as part of metadata (3.PPT & more)	Longley Ch6 + LinkVit M14 & M2
6-mar	XML and GML as Standards for SDI (4.PPT)	LinkVit M6
13-mar	The 'Access services' component of SDI: WMS, WFS (5.PPT)	LinkVit M4
20-mar	The 'Access services' component of SDI: Exercises	LinkVit M9
27-mar	The 'Access services' component of SDI: SWE (7.PPT)	LinkVit M21
3-apr	Other services related to SDI: RTK Positioning Service (8a.PPT and 8b.PPT)	www.agiv.be
24-apr	The organisational component of SDI (9.PPT)	LinkVit M5, M8 & M10
1-may	International Labour Day	
8 & 15 may	Data harmonization	LinkVit M1, M11 & M12

5. Proceedings

General information on the course is available at the KU Leuven website:
https://onderwijsaanbod.kuleuven.be/syllabi/e/I0U99AE.htm#activetab=doelstellingen_idm4515824

The course material (presentations, assignments, exercises) have been made available through the student platform of the KU Leuven (<https://toledo.kuleuven.be/english>).

6. Event outcomes

The KU Leuven Training Action was the Master Course on Spatial Data Infrastructures at KU Leuven, in which the LINKVIT material (presentations, exercises, tests, etc.) was used as the primary teaching material. The Master Course on Spatial Data Infrastructures is a course of 6 ECTS and 52 study hours, taught by prof. dr. Jos Van Orshoven. The course is included in several

Master Programs at KU Leuven: Master of Geography, Master of Agro- and Ecosystems Engineering and Master of Bioscience Engineering.

The KU Leuven Training Action was a valuable initiative for testing the relevance and usability of the LINKVIT training modules in the context of an academic master programme. One of the key strengths of the Training Action was the integration into the official master programme of the KU Leuven. Although the training action was not organized as a separate training action, the LINKVIT training modules were used as a basis for organizing lectures, exercises and assignments as part of the course on Spatial Data Infrastructures. This also means the content of the course was not limited to INSPIRE, but the focus was on Spatial Data Infrastructures in general. Therefore, the KU Leuven Training Action can also be considered as a valuable assessment of the applicability of the LINKVIT material for training and education on the topic of Spatial Data Infrastructures.

7. Follow-up

Outcomes of the evaluation of the modules by the students will be used to further improve and update the modules. A detailed overview of the information provided by the students is provided in section 8.

Also the experiences and comments of the teacher (prof. dr. Jos Van Orshoven) and the teaching assistants (Olga Zalamea & Glenn Vancauwenberghe) will be used as input for further improving the material.

The course will be offered in the 2015-2016 academic year (second semester), using the updated material.

8. Quality evaluation

The evaluation of several LINKVIT modules was part of an assignment that had to be made by the students. In this assignment, students were asked to write a report on the following 4 topics/questions:

1. General experience in working with and studying the materials. *Do you think that you have achieved the learning objectives listed above? Are you confident about your knowledge, skills and 'where to find additional information when required' to engage in further research or professional activities?*
2. Three strong points or parts of the materials and related teaching approach, with arguments, for both the module on 'Data Quality' and the module on 'Basic concepts of XML and GML'
3. Three weak points or parts of the materials and related teaching approach, with arguments, for both the module on 'Data Quality' and the module on 'Basic concepts of XML and GML'
4. Assessment of the estimated effort for the modules. *The module on 'Data Quality' was designed to require a 12 hour effort while the expected effort for the module on 'Basic concepts of XML and GML' is 16 hours . How many hours did you effectively spend in total for (i) the contact sessions, (ii) individual study and exercises, (iii) preparation for the exam?*

Below, the individual answers of the students on each of these 4 questions are presented. The modules discussed in the evaluation are 'Data Quality' (Module 2); 'Basic concepts of XML and GML' (Module 6) and 'Metadata and data validation for INSPIRE' (Module 14).

General experiences

- 1 In general, the LINKVIT modules have shown to be very useful material. It is however difficult to see the material separate from the contact sessions given in the course. Most of the material was handled in class, so it is also difficult to judge the comprehensibility without any foreknowledge. However, a clear distinction can be made between the two modules.

First, module 2 (and the additional pdf file from module 14) were very descriptive and extensive. The lectures were comprehensive and slides were well elaborated. The attached literature gave a thorough background for the used material. At the end of the whole module, the predominant feeling was completeness.

On the other hand, module 6 gave a crude impression. It mainly forwards the user to other online courses. Personally, I was happy to have a basis in working with HTML and UML. Otherwise I fear that solely relying on the LinkVit module, I would not have reached its goals.

- 2 The use of the LINKVIT modules was an enjoyable and educational experience. For the covering parts, it made the understanding much easier. However maybe some parts can be elaborated (see above), it does its job in achieved the learning objectives. Hereby it seems to me that these kind materials could be of great use for others in in the future. Also modules that were used later in the year proved they're worth.
- 3 Generally the modules work in the way they should. They offer easy access to the different topics concerning SDI and INSPIRE and are generally constructed in a logical way. I have certainly acquired additional knowledge about the components of an SDI, on top of what we have seen in class. However I do not believe I could have obtained a 'thorough' knowledge of the subjects trough the LINKVIT modules alone. The presentations in the modules do not really go in depth on the most important subjects. It is also not realistic to expect that one example about a certain programming language will make you capable of writing it yourself. I needed to consult the solution videos for the XML code in order to be able to write it myself. The modules thus offer a basis, on which the student can build according to his/her interests.
A bit unrelated but still relevant was the fact that working with the LINKVIT modules in combination with the lectures was sometimes a bit confusing due to the volume of PDF's and other files. It would maybe be better to clearly separate the real 'learning' material and background information. Also in the references to the modules in the lectures contain wrong numbers, adding to the confusion.
- 4 In general, I think LINKVIT has some potential. The aim of achieving the learning objectives is reached in my opinion, because thanks to working with both modules I acquired some theoretical knowledge about metadata, XML and GML (by reading the Lectures and the Readings), but I also learned to apply this knowledge in a practical way (by doing the Exercises). However, there are some points of improvement (see "weak points"), I think that the LINKVIT still needs some reworking.
- 5 Generally speaking, the LINKVIT materials are well organised and structured, and it is easy to find your way with the materials. I think the resources are generally good for achieving the learning objectives of the course. I am fairly confident with my gains in

knowledge, although more so theoretically than practically, although with the links given in the material I know where I can go to develop my understanding and practical knowledge.

Lectures => On the whole the lectures were understandable but I found some aspects a little lacking. I think that the lecture slides, as they are for self learning, could have been a little more self-explanatory at times (i.e. what is written on the slide). Although with the spoken element of the slides there is more clarification, I believe that slides should be clearly understandable, with the spoken or written notes simply going into more detail on what is written on the slide (e.g. the M6 Module on XML and GML). I preferred the slides for M14 (Metadata catalogues), with a written explanation for each slide, as I am more a visual than an audio learner.

Readers => Some of the reading material was useful, e.g. for M2 (Data quality) and gave a more comprehensive understanding of the slides. As for the material given in M6, this was more complicated. The user is directed to some online tutorials. I initially started with the suggested tutorials on the www.brainbell.com website, however i found that as it was very detailed, it became quickly became far too much information to digest in one go, especially for someone with very little background knowledge. I found the second suggested tutorial on www.w3schools.com much easier to understand and assimilate the information.

Exercises => The exercises for M2 (Ex1 and 2) were fine, but for Ex3 there is no actual explanation on what is supposed to be done i.e. no clear task set - I had to look at the answer to understand what the exercise actually was. As for M6, some of the exercises were fine, but I found some of them challenging e.g. The exercise for creating an XSLT conversion to convert an XML file for display in a web browser. While I understand the concepts of XSLT and other aspects of the tutorials, to carry out some of these exercises needs additional knowledge of HTML, or more extensive practice with the tutorials, in which case the study effort becomes significantly more than the estimated 16 hours.

Exercise solutions => I consider this part to be an indispensable part of the material. It really was very useful to have the video solutions showing step by step the actions necessary to obtain the correct answer. This is very helpful in understanding. Some points that could be improved with the videos is that the sound quality is not always clear, and some aspects of the video were in Swedish, although that did not significantly impact my learning.

Self test => I think this is a useful part of the materials given. It is good for testing how

much you have understood of the material, and possibly identify some aspects of the material which is still not clear.

6 Although I do not feel 100% comfortable about the knowledge, I have the feeling I learned a lot in a fast way. I do not feel that comfortable about XML/GML that I could use it right away in other environments like a business environment. Still, I am satisfied with what I have learned during the presentations. The issues on data quality were not always new, so that was also more easy to follow. XML/GML is something completely new for me, and presentations of several hours have already explained a lot of theoretical and practical issues for me. Using xml editors, schemas and where to find more information is definitely possible after the module. While before the module, the actual differences between XML and GML and how this is used in SDI was not always clear. To be completely comfortable with it, a good revision after the exam would be perfect.

7 In general I think that it was a good learning experience. It was easy to register on the site and to enroll in the modules. At the LINKVIT site it was quite easy to find information about different courses. The modules 2 and 6 that were required for the SDI course were also present on Toledo. But when opening these files I couldn't load the sound. That is why I used the site to open the slides with sound. Here the sound worked perfectly.

I have learned that compiling metadata can provide an added value to SDI. The goal of learning to interact with SDI I didn't really acquire throughout these modules. I think that the rest of the SDI course and other courses like GIS provided more understanding of these aspects. The LINKVIT modules didn't provide a lot of added value to this aspect. The last objective that was set was to acquire technical knowledge. There was enough of information in the modules about this subject but I am not confident that I truly have acquired enough feeling with this practice. So to know if I really achieved this goal might become clear at the examinations. When I would acquire additional information in the future I am very confident that I would be able to find it.

8 In general I think the studying materials are good to achieve the learning objectives, to have a good knowledge and to exercise your skills. The documents with the additional readings give good sources to find additional information and tutorials. However I have to say that without the additional readings some things would not have been completely clear to me. Also it is disadvantageous that I continuously needed to switch between different documents (lectures, readings, exercises...). It should be better to have 1 or

maybe 2 documents (course text + exercises) per chapter/module with all the information. Also I'm not completely confident about my skills with working with OS GML viewer. Some more exercises or tutorials would be useful.

9 In overall, I believe I have acquired knowledge of the technical components of SDI, especially metadata catalogues and standards pertaining to data quality. I have learnt about data quality assessment (DQE, DQE Procedures, Sampling...) and metadata creation and validation for INSPIRE. I feel more confident know after going through these training modules than before about metadata catalogues and repositories and data quality evaluation, feel that I have more knowledge about where I can look for data, understand data and also, a have more confidence as a producer of data not only as passive user, which enhance further professional activities. Having experienced different methods of learning materials, in my opinion, it might be better using a presentation with audio rather than a unique PowerPoint presentation, because the concepts introduced in a text are clearer if someone explains more about them (professor role). Comparing and contrasting the modules, I firmly believe that I have achieve better understanding of the contents of those modules with video material, exercises and solutions, than those modules without audio or exercises (module 2, module 14- without exercises). Might be seen as a trivial point, but firmly consider relevant and valuable the audio explanations and some notes aside of the video (most important as it is a self-learning modules). On the other hand, I have missed exercises related to metadata compilation: how to create a metadata XML file, upload it for example to INSPIRE GeoPortal and validating it, because, in future professional life, that is the kind of work we may have to do as geodata producers.

10 In general the self-learning material was tackling interesting topics (Data quality [module 2], Basic concepts of XML and GML [module 6] and Metadata and catalogue services [module 14]). The modules are organized in a very structured way. I have achieved the learning objectives stated at the onset of each module. The first source to search for extra information was the world wide web.

In general, the exercise description and the goal of the exercises were not clear enough to complete the exercises independently. The exercise solutions are provided with a video, which is a very good medium for a self-learning course. The audio quality can be ameliorated and the spoken solution is not very fluently. The author's personal computer settings are in Swedish instead of English, which is confusing. The self test provides a good test to check whether the learning objectives are accomplished. Estimated time e ort for each part (Lecture, Reading en Exercises) would ameliorate

these modules even further.

- 11 Not much of the offered material was really new to me personally. I have edited and generated metadata during my internship, and I have also been using xml. Much of the data quality information I had already received in previous courses. Using xml to design databases and create schemas from scratch was however new to me. My general experience has been positive. The material is offered with a good structure, and it is easy to use. I also like the usage of exercises that go back to the theory and implement it. For example, I thought that I got the idea of xml and gml, but in the exercises I discovered that I did not master it fully yet.

By going through the material, I believe I have acquired the basics of the learning objectives. This means that I do not feel ready to go to an exam about the subjects yet, but I feel confident that by reading it again I will have prepared enough. As stated above, I already knew (elements of) most subjects, but I can see how this material provides all that is necessary to gain the learning objectives. The material references quite a lot of relevant resources for extra information or useful tools, so I am confident that I will find enough information when needed.

I had a much more negative experience with module 14. The slides as well as the person giving the lecture were often merely going through syntax. Learning syntax is something I would not do through a lecture (maybe only the basics), but rather with exercises. The lecture seemed unnecessary.

- 12 My general experience of working with these LINKVIT materials is quite positive. Through the M6 module, especially using the lectures and web tutorials, I acquired a clear understanding of XML and GML as underlying standards of SDI, whereas the M2 module stressed the importance of assessing data quality via different measures. The lectures and delivered reading material were surely extensive enough to understand the basics of data quality evaluation and XML/GML respectively (objective 1). The exercises on XML and GML learned me the underlying framework of (geo)datasets, in compliance with the second objective. The same holds for the Excel exercises of the M2 module to calculate different data quality measures. Though I am not sure if I already acquired enough skills to deal with problems different from the given exercises, especially for XML and GML related exercises. Yet the LINKVIT modules clearly offer a good starting point to deal with SDI and its various aspects. If necessary, I will certainly find my way to the LINKVIT portal to explore the other training modules.

- 13 The LINKVIT materials were in general really useful to understand and acquired new knowledge about Metadata component of SDI and XML--□GML standard. I just

consider that the way, both folders are made, is a bit repetitive. Moreover you do not always need all kind of information. There are several pages to introduce or about the different version of the module. I would prefer one long file with a clear table of content and if you need or you desire to reach a certain page concerning for example the versioning, you could click on it. I think I reached the goal of acquiring new knowledge about data repositories, metadata catalogues and technical standards regarding these repositories and catalogues. I learn also how to discover and to explore the geodatasets, but I not really sure if I could easily exploit them because you need either to pay a fair contribution or to obtain certain license.

14 For all LINKVIT modules the contents are very clear, having a general introduction in the beginning which describes the contents and goals of that specific module. The structure of the modules are also convenient, building further on the knowledge of the previous lectures. The pace is not too fast, but not too slow either. This setup, combined with a self testing environment at the end of the modules, is a very good way for self-learning the information inside these modules. They contain links to websites that have good educational value and definitely improve one's understanding on the topics compared to someone just looking for the information on the web. It is well structured and coherent, making learning the different components of data quality or XML/GML much easier. Users of these modules can acquire a thorough knowledge of the technical components of SDI and XML/GML. The modules contain enough detailed information to let the user understand the whole concept behind these components as well as work with them. However, for the modules in this assignment, discovering SDI is not really a part of the modules. Understanding how the SDI is built with its metadata is thoroughly explained, but the action of discovering said metadata is not really described in these modules. However, this is handled in LINKVIT module 9 and thus users of the LINKVIT modules will probably go through this module as they are leaning about SDI components. It just happened to be that data discovery was part of our course lectures and not this specific assignment. Other than the SDI geodataset discovery issue (in these specific modules for this assignment), I can say that the defined goals have been reached. Finding additional information should also not be a problem; the LINKVIT module already offers great links to educational websites.

15 In general, I really like the format which is used in the LINKVIT studies. The narrated slide shows are really helpful, because you can get so much more out of them than just reading the slides. You can get some extra information behind the written words of the author and, more importantly for me, you can rewind and listen to it again. I personally

feel that I learn quickly from this kind of lecture and a lot of the information sticks. On the other hand, some of the audio tracks were not that qualitative. Next to that, I thought that the lecturer of the “Data quality” lecture did not really add a lot of information to what was already in the slides. The “Metadata component of SDI” lecture was very good. The lecture on “XML & GML” was very long, but it is interesting that you can break it up in shorter presentations (which is not possible in real time lectures).

Like I said above, I think I mastered a lot by just listening carefully to the slide shows. This resulted in high scores on the online self-tests (although I missed the “one or more answers are possible” sign for the M14 test).

It was quite confusing that the modules on the LINKVIT site were numbered differently than the ones we received through Toledo. M2 on Toledo was M6 on the LinkVit site, and M2 and M14 on the LINKVIT site were actually totally different lectures than the ones we were supposed to go through for this assignment.

Strong points

1.
 1. A first positive point is certainly the clear structure, metadata and uniformity. When you start a module, you know exactly what to expect from the first two documents (“metadata” and “readme”). After one module, you get the structure of the LINKVIT material and it is good to see that over the different modules (also outside modules 2 and 6) the homogeneity is remained.
 2. The attached video and audio material is a great advantage of the modules. Although there was no sound for us (because we only got the pdf-format), I can imagine that hearing someone explain the subject in his or her own words, results in a better understanding. The material we did have, were video solutions of the first exercises of module 2. I found these videos extremely useful since I was making some bad programming choices when solving them.
 3. A last positive point for me about the teaching method is the ability to spread the work. The clear distinctions between the separate parts of the modules make it possible to divide the workload over a longer period of time. This helps in lowering the stress to achieve deadlines, which is very grateful for master students. For example, during the contact session of the course it was important to have an understanding of theory and concepts before going to the next class. Therefore, the “Lecture” material was ideal. However, during the exam period more in depth information and exercises are needed to prepare.

2.
 1. First it can be said that LINKVIT manages a good bottom up approach. Hereby this low entry level assures that the readers can understand the subject matter even if they have little experience with this curriculum. This made it possible for me to go straight to work without taking into account the previous lessons. Even while studying for the exams this was a gain.
 2. When looking at the exercises it was very handy that the solutions were available in video format. It gave the opportunity get a good explanation of the task instead of only the numerical solution. For example exercise 2 of module 2; I had trouble understanding the question. The video could show me the precise operations I had to undertake to get to the right answer. The dexterity of a visual solution was hereby missed for task 3 of Module 2.
 3. A third benefit of the LINKVIT Modules is undoubtedly the self-tests. These are not

just good for gauging your knowledge but they also indicate the main points of that module. This ensures that you're always aware of the key issues. These advantages can also be applied to module 6. Additionally it can be said that this module 6 was generally better than module 2. Although the matter certainly was more difficult and challenging, the slides could fascinate me better, probably due to its optimized formulation. It made use of XML and GML and in the exercise more doable and allowed it to easily distinguish the two from each other.

- 3
 1. The videos containing the solutions of the exercises are very useful, as they completely describe the process.
 2. The exercises generally do form a good application of (parts of) the theory presented in the lectures.
 3. The lectures form a good starting point for further research. They are well organized, which makes discovering the materials easy.
- 4
 1. The LINKVIT modules have a clear structure: with the help of numbering the pdf files it is easy to follow the approach. Also the use of letters (E, L, R, ST) is very useful in my opinion.
 2. The use of examples, e.g. experiences with metadata in national mapping agencies in the Jacobsson (2002) paper (M2), makes it easier to understand immediately what is meant with the concepts explained in the lectures.
 3. The concepts in the powerpoints are in general well explained by the recorded voice and the videos with the solutions of the exercises certainly contributed in a better understanding of the exercises, however the size of the videos was rather large (so it took a while to download these).
- 5
 1. Interactive and innovative methods. I appreciate a lot that the theory is mixed with the practice (exercises). Slides with an oral explanation make it easy to study and comprehend the materials. Thanks to the possibility of stopping and rewinding the recording, it is possible to listen to the lectures at the full concentration which is especially important for people who have problems with focusing like me.
 2. Complex teaching consisting of lectures, exercises and tests. Moreover, one can broaden the knowledge on the topic by going through the additional reading materials and tutorials in the links. All the content is clearly structured and logically ordered from the easiest and most basic gradually to the most complex material.
 3. Exercises are provided with the solutions, therefore it is possible to check if we did the assignment correctly. If one has a problem, it is possible to consult the video, where everything is interactively explained step by step. Moreover, a self-test at the

end of each module allows to review all the information and to make sure that we comprehended the study material well.

- 6
1. Exercise solutions & self test - It is important to know where you have gone wrong, and how it should be done or understood. The video-format is particularly useful.
 2. Good mix of materials => Lectures, reading, exercises, allows for a range of different ways to learn, exercises are particularly important to implement and better understand the theory.
 3. Preference for the written notes with the slides (M14) - I had a better understanding
- 7
1. After several slides of theory and explanations, the practical examples are very useful to summarize what is really important. It also helps to memorize it and you have a deeper understanding of the topic.
 2. The solutions of the exercises are recorded on video, and not just written down. For these kind of exercises, that is much more useful. I really needed the video solutions to fulfill the exercises.
 3. The possibility to listen to someone's explanation while looking at the powerpoint presentation is great advantage. The material is rather technical ('droog' in het nederlands). Listening to a voice and looking at slides will make the presentation much more efficient for the student. Moreover, it is (personally perhaps) less likely to lose my focus when I can also listen to the explanation.
- 8
1. The modules were well structured: an abstract, learning objectives, lectures, exercises, self tests and solutions of the exercises and tests were all present.
 2. The recorded explanations with the slides and solutions were very helpful. These recordings make it more clear witch slides are more important than others. Also the given examples are a lot more clear than without the explanation. I think the recordings provide a nice extra input in the learning process.
 3. The content of the lectures was good. A lot of examples were given and the explanations were clear. Also the recorded explanations of the solutions for the exercises that were provided were good. The explanations were slow and clear so that it was easy to follow.
- 9
1. The exercises and self tests were very useful to test if you know and understand all the theory. I tried to do these without looking in the slides but for some questions I needed to look into the slides because I was doubting between different answers or I couldn't remember what it was
 2. The additional readings next to the lecture slides were very useful if something in the slides was not clear. The examples in the slides on the other hand were most of

the time very clarifying next to the theoretical formula and explanation

3. The general structure of the slides was very good, also the order (first read the lectures, then the additional readings, then the exercises on each part) was also good.

10 On module 6:

1. Absolutely complete, well-structured, teaching, useful, well-explained,...: Is has everything to achieve all the goals that the module is thought for: it is divided in three parts, each one has a presentation with voice, a PDF document of the presentation, reading instructions, and there are exercises for part 2 and 3 (with video and document solutions), and a self-quiz at the end.

2. Well explained the presentation with audio, the author explained with clarity each concept, went step by step and illustrated every point with examples (which facilitates the labour of understanding).

3. The exercises are well structured and related to which has been said in the theory. Going over exercise 1, the user can get an idea of how it is to do a data quality evaluation of a database, first selecting which of the data quality elements are the most relevant to be evaluated, and after, the user can go through the data quality procedures of evaluation to assess the quality of the database. In this exercise, 4 data quality elements where calculated, and I found the video solution highly helpful, when the user is stuck at a step and don't know how to continue, in the video solutions was perfectly explained what to do.

On module 14 (Metadata and data validation for INSPIRE)

1. Liked when the professor explained the way to go from ATS to ETS
2. The presentation was short and not too complex
3. Focused on the points

11 On module 6: Basic concepts of XML and GML

1. There is a strong link between the theory and the exercises. A pitfall here is however that some (especially the first) exercises become somewhat of a copy of the material shown in the theory, which makes it too easy to just copy-paste. However, in general, this link helped me to keep track of what I was doing and seeing the bigger picture.

2. The lecture refers to both professional software (Liquid-xml) and open source alternatives. This gives you an idea of the different types of xml editors. I was personally surprised by how well the graphical code-generating interface of Liquid-

xml functions.

3. In general, this module gives a very good overview. It always zooms out to the big picture before zooming in on the next aspect.

On module 2: Data quality

1. The material is offered in logical parts. This is a large subject, and offering all the material in one lecture would possibly result in less learning efficiency.
 2. Data quality elements were not only listed, but given in (UML-) diagrams. This challenged me to think about them more deeply, and meanwhile I refreshed my UML knowledge.
 3. The view of different organization on data quality was also given. The last lecture listed some papers that point out how users and producers think about data quality, showing the difference in views. This way, the lecture went beyond the technical aspects.
- 12
1. The lectures of the M2 module gave a very clear and structured overview of the different data quality elements. L1 was rather theoretical and introducing. Yet the primary reading paper (R1) and L2 illustrated the different concepts well enough with some examples. I had more difficulties with the lectures of the M6 module. Therefore, I decided first to go through one of the R1 tutorials (<http://www.w3schools.com/default.asp>), which was very helpful to understand the XML concept.
 2. Going on from the previous point, the suggested reading material was very helpful for the M2 module, especially the first theoretical part of Jakobsson's (2002) paper. For the M6, the internet sources were highly supportive. Also, I prefer web sources to reading papers, especially to understand common concepts. The module mentions that for the GML no internet tutorial could be found. The Wikipedia source in R2 did not really fulfill my understanding about the concept, thus I searched for another tutorial which actually did exist (<http://www.w3.org/Mobile/posdep/GMLIntroduction.html>).
 3. The exercises delivered a great opportunity to deal with some practical SDI related applications, which let you think about applying the theoretical concepts to real geodata. However the exercises sure were of added value, some remarks are given further.
- 13
1. The pdf presenting the subject (metadata and XML-GML) are really complete and

clear.

2. The oral and interactive solutions of the exercises are very useful and perfectly understandable (for the power point the voice does not bring additional important information it just reads)
3. The self tests are nice to point the knowledge you acquired and the one you did not but the solution should contain a sentence that explain why a bit further and situated where the information is developed in the slides.

14 On module 2:

1. The given lectures (with the use of the LINKVIT information) was a good kickstarter that created the right environment to keep learning more about Data Quality. It went through all the basics and gave a good understanding of where to look in Data Quality. Not having this lecture would have made it much more difficult to understand the basic concepts of Data Quality, especially since the information on this is more restricted than Module 6.
2. The exercises were helpful and gave a good example of how to work with Data Quality. The context of the exercises made it clear that we can even use simple tools such as Excel functions to describe Data Quality of geodatasets.
3. The provided literature (R1/2) was helpful to give an idea about practical examples of Data Quality and enhance the basics learned in the lecture.

On module 6:

1. The links provided in the LINKVIT module gave access to very educational websites¹. These websites were a great tool to learn more about GML/XML. Especially the Brainbell website offered a detailed, step-by- step guide on XML and its components, guiding people with any amount of knowledge through the information.
2. The LINKVIT module provided good tools, as well as a comparison on Brainbell that gives detailed information on various XML editors out there, useful for those new to XML and not having a clue what the good or not so good ones are.
3. I had already worked with XML/GML and knew what it was about. The very detailed structure of the LINKVIT module (and its website links) proved helpful to choose the topics I did not learn yet.

- 15
1. Like mentioned above, I really liked the style of teaching adapted in the LINKVIT tutorials. The fact that it is narrated, makes that you can really follow the thinking behind the written slides of the authors. Personally, this is an ideal learning style for

me.

2. Secondly, the fact that they make you do these exercises is very handy. They were quiet difficult though. For the “data quality” module, they assume that everybody knows how to work with Excel. That might be an overestimation of most people’s capabilities (including mine). Having the solutions is a bonus in that perspective, certainly because everything is carefully explained in a video. For the “GML & XML” module, I felt kind of ‘lost’ in the exercises even though I feel like I understood everything mentioned in the lectures. In that kind of situation it is a too easy option to just go and look to the solutions.
3. It is good that they ordered their lectures, readings and exercises on the site. It is very handy to just go through them one by one.

Weak points

- 1
 1. Personally, I am a big supporter of going to every class as a student. I believe that the most important information during a lecture is the personal view and approach of the teacher. And that this personal approach results in a better and more attentive incorporation of the study material. In my experience this is much harder when working on new material from behind a desk and laptop.
 2. As stated before, I believe the material should be well documented and the basics of the concepts should be clear in the material. In module 6, a lot of images were used without any further explanation and the student is often redirected to other online courses. (In defense of the module, we can say that the audio material was not available, so it is difficult to predict how clear the information with this material would have been.)
 3. After each module, there is a small self-test to see whether or not you understand the principles. However, this is no indication of the completeness of the material. I find it very difficult to assess whether everything you need in the professional world is provided. For module two this is partially solved by adding literature about “Data quality in practice”.
- 2
 1. A downside of LINKVIT modules was the extra readings. When trying one of the texts it became directly clear that huge amount of literature wouldn’t be of great worth for studying the matter. I myself found the presentations more clearly seemed to making a thoroughly review each text of lesser value, especially since it take a lot of time to get trough it completely.

2. Although it was also mentioned as a positive point, the self-tests could be a bit more elaborated. Hereby these questions could have even more sense to the student. A suggestion would be to extent the question with graphs, figures or even maps to make it more applicable for real situations.
3. A (maybe silly) last compliment about the slideshows was the fact that for module 2 the slides were only available in 6 per page view that made it not at all easy to study from a laptop.
- 3
1. The tutor of the module on XML and GML often had long pauses in which he did not know what to say. Often he also just read what was mentioned on the slides, reducing the added value of the spoken presentations (which are otherwise very useful. During the first presentation of module 4 the construction of XML was explained using static slides while I think it would be better to use a video; however such a video was present as an exercise solution.
2. The reading of module 6, in my opinion, not the best choice for the subject. The first reading (Jakobsson, 2002) gives some examples of quality measurement in different institutions, but is often overly technical. It also offers mostly anecdotal information about very specific use cases. It would be better to offer a general review paper of the state of quality measures in SDI. The second reading material offered four papers containing basically the same information, which was a bit much.
3. In module 4 the extra reading provided in reader 2 were simply some Wikipedia articles about GML and map projection. It would have been much more interesting to include some real world applications of GML. The first reader contained some links to XML tutorials. This is not really helpful, as I can obtain the same list by searching for 'XML tutorial' in Google. On top of this the basics of XML had just been explained in the presentation, so it is quite redundant to offer the same info twice.
- 4
1. In my opinion, the exercises are less elaborated than the theory. The third exercise of M2 was very unclear because there was no task: it became clear what I should have been done exactly after the solution was given. Furthermore, the task of the exercises of M6 was also not clear: although there is more information given about how to work with XML and GML in the powerpoint about XML and GML (Lecture 1 and 2 of M6), on Wikipedia and in the BrainBell tutorials, I didn't know how to start with the exercises. Therefore, I only watched the movies with the solutions. A suggestion: adding a step-by-step approach to the module about how to work with XML editors, e.g. like the "Exercises for the Hands-on Training on INSPIRE Network Services" tutorial that we used for Assignment 1, would be definitely an improvement.

2. The follow-up of the modules can be better, because some of the links didn't work, e.g. "Boin A.T, Hunter G.J, 2006. Do spatial data consumers really understand data quality information? 7th International Symposium on Spatial Accuracy Assessment in Natural Resources and Environmental Sciences. Edited by M. Caetano and M. Painho. <http://www.spatial-accuracy.org/2006/PDF/Boin2006accuracy.pdf>" in Reading 2 of module 2 and "OGC, 2007. OpenGIS Geography Markup Language (GML) Encoding Standard, OGC 07-036. file:///C:/Users/Anders/Downloads/07-036_Geography_Markup_Language_GML_V3.2.1.pdf." in Reading 2 of module 6. A regular check of the links, for instance every 3 months, could prevent this.
- 5
1. However, the self-test is in the form of A-B-C-D closed questions. These type of examining does not indicate so well if one really understands the topic. Nevertheless, I understand that the open questions would be more difficult to evaluate. Moreover, these questions are rather easy and sometimes some of the given options are quite clear to be false. Therefore in some of the cases, one can answer the question by simply eliminating the least probable options. A solution here for the user would be just not looking at the possible answers before thinking about the question.
 2. Regarding the lectures in module M6: they could be in the interactive form just like the solutions to the exercises. The teacher tries to explain in the slide the code and the functionality of the program, while it would be better to do a video-recording in which a teacher could interactively type and explain the syntax at the same time. This way it would be easier to grasp the details in the code and to understand the functioning of the program by following the mouse cursor. Moreover, those screen shots of the software in the lecture slides have simply too small text. It is not a problem when using a PDF material, where one can zoom out to the code but by listening to the lectures on gisig.eu website, I was not able to enlarge the slide and play it in a full screen mode.
 3. The final point considers the teacher himself and the quality of the recordings. In my opinion the lectures could be delivered in more fun and interesting way. The teacher in most cases simply reads the slides and does not explain the problem very well. I will not mention occasional grammar and pronunciation mistakes. What is more, it seems that in some parts the recording is interrupted or slightly cut at the end.
- 6
1. Some slides not self explanatory enough (especially for the lecture on XML; although if combined with the sound aspect, it is more understandable).
 2. Some exercises too challenging for the estimated time given (e.g. XSLT conversion)
 3. Quality of video can be improved.
- 7
1. Technical improvements should be made regarding the resolution of the videos and

screenshots in the slides. At the presentation of XML and GML, the screenshots are too blurry to interpret the figure properly. Also the solution-videos can use a higher resolution. Another thing is the problems with the audio during a presentation. Very often, the sound disappears for several seconds. This can be somewhat annoying and seems not that hard to improve.

2. For the exercises of both XML/GML and data quality, a little more explanation could be provided. Certainly for the exercises on XML/GML because a different software was used in the presentation. It was often hard to find the right way to do it yourself. With some extra guidelines or subquestions in the exercise, the exercises could go a little smoother without immediately checking the solutions.
3. Try to use more structure in the slides. All the titles have the same font and layout. Therefore it is not clear where you are heading to when following the presentation. If the beginning of major chapters have a different layout than a small detail of a subsection, it is easier for the student to make notes and follow the tutorial.

8 On module 2:

1. It was sometimes too wordy. I found that in module 2 lecture 2 was quite similar to lecture 1. Lecture 2 mainly gave examples about the things already explained in lecture 1.
2. I also think that there were too many examples. Examples are good to understand the theory but here I thought that the examples were too long. After a while it got boring.
3. In module 2 the question of exercise 3 was unclear. Some data was provided but I didn't know what I had to do with it. No clear task was given. Even when looking at the solution the goal didn't really become clear to me. It was something about giving data quality elements but I didn't understand what the question exactly could be. As a consequence I don't know if I achieved the goal of this lecture or not.

On module 6:

1. The examples of the XML-files and schemes were very good to understand
2. The additional readings were very clarifying next to the slides and gave clear information.
3. The self test and questionnaires were good to test your knowledge and skills.

9 On module 2

1. For M2 I was missing some text with the slides. For M14 each slide was accompanied with text, clarifying what was on the slides, but M2 did not have that clarifying text what made it often difficult to understand what was on the slides (mainly on the part on

specifying and reporting data quality).

2. I had some difficulties with the first exercise in excel. I did not know all the formulas to solve it in an efficient way. For the completeness of occurrences and the positional accuracies my results don't correspond with the correct answers and I don't know what I have done wrong. It is difficult to find out what you did wrong if the answer is not correct.
3. For some parts of the slides I was missing an example, eg. how to calculate the domain consistency. The definition was given but no explanation of how to calculate it. In the exercises we had to calculate it but first I had no idea how to do it. Also the part on specifying and reporting data quality was really not clear to me.

On module 6:

1. I printed out the slides with 4 slides on a page. The slides with the examples of the xml-files and schemes in liquid XML studio and screenshots of web pages were really not readable. Even on my laptop screen with the whole slide on the screen it was sometimes not clear (eg. The difference between = and -)
2. The slides of the 'introduction to GML' part had spoken parts (the speaker on top of each slide), but I was not able to click on it. Therefore I think that I missed some really useful information to do the exercises and self test. I was able to do the self test relatively well (9 of the 12 correct answers) based on the theory of the slides, but I was really missing some good information to do the exercises (mainly the second set of questions: Introduction to GML). Also the URL (eg the URL at slide 25: Unified modeling language) were not always working.
3. There was too much text in the additional readings, I tried to read it all but sometimes it was just too much information. Maybe it is better to select the useful information and put it in the slides or make 1 document with all the useful information for this course and leave the rest out?

10 On module 6:

1. In exercise 2 of part 2, the exercise was related to the theory (it showed the user how to do an evaluation using a random sampling). What I disliked is that for being able to complete the exercise, the user needs to have a previous knowledge or background using the stored formulas in excel, in order to achieve the goal of the exercise. But, as this might not be the case of every user, the video solution was as well perfectly explained what to do, useful, and teaches the user how to do a random sampling evaluation.

2. Found part 3 quite not related to the theme: learning Reporting Data Quality (in INSPIRE, etc.) I found it instructive, but when introducing the concept about Fitness for use, it is presented several conceptions described by practical examples (Limitations of products (Frank 1998); Examples of data usage (Gould, 2005); Interrelation with other datasets (Thompson et.al, 2005); Effect on decisions (Rönnbäck, 2003)) I found it a bit non-clear, and the examples where not much illustrative.
3. As final last weak point, I would outline that in exercise 3, as a user, I did not know what I should do to complete the exercise.

On module 2:

1. The module was given through a presentation without audio (in PowerPoint or PDF format), where the information was extremely summarised. The only outcomes as a user I may have achieve are enhancing metadata search and obtaining more knowledge about European geoportals.
2. Some topics questioned in the self-quiz questionnaire were not explained in the module, such as: satellite data providers, benefit of geodata portals (which was one of the goals to achieve), goals of Europe-wide spatial data search and INSPIRE.
3. The expected time of the course is less than the estimated (4-5 h). It is stated that exercises will take between 1-2 h, but there are no exercises linked to the module

On module 14: (Metadata and Data validation for INSPIRE)

1. The professor reads the PowerPoint: does not explain additional information to clearance want it is already written in the text.
2. Added figures that are not readable (for instance in slides 8 and 9)
3. There are no exercises proposed. With exercises content introduced in theory it is clearest. So, for example, some exercises could be proposed such as creating an XMLfile with INSPIRE Metadata editor or upload a text file to INSPIRE with Metadata. This Metadata could be afterwards validated using Metadata INSPPIRE validator tool. Another exercise could have been proposed to teach to use GeoNetwork tool, for learning how to write the compulsory metadata.

11 On Module 6: Basic concepts of XML and GML

1. On a formative note: the sound quality was often very bad. There are gaps in the speaking, and this is not due to a bad internet connection. This made it difficult to stay focused.
2. The Snowflake GML software is referenced and used in the exercises, but this

software has been discontinued.

3. The lecture is very long, and often, the lecturer is just guiding you through syntax via screenshots of code. This did not teach me a lot. I would suggest a shorter lecture, but more elaborate exercises instead. These exercises should in that case be more guided.

On Module 2: Data quality

1. Also here, the sound quality was bad, even worse.
 2. The first part of the second lecture is almost exactly the same as the first lecture, but with examples. I can see why they first give you all the theory and then some examples, but this made the first lecture rather vague, and the second lecture a bit too much repetition.
 3. In exercise 3, there is no real 'assignment' given. You are just given some data. I had to go to the solution to get what was expected from me.
- 12
1. The way the exercises are organized might be improved. The explanation of the exercises was not always clear to me, for both M2 and M6, and I didn't always know where to start. For example for exercises 1 and 2 of M2, the Excel file was rather vague. Same goes for exercise 3, of which the purpose was not directly clear. The exercise referred to the L3 PowerPoint, but it took some time to realize that the exercise was just about checking the applicability of the different data quality measures.
 2. Personally, I would prefer a detailed step-by-step written guide to the vocal video explanation for the M2. The audio quality was not always optimal and I think it takes more time to play the video, listen to the commentary and copy each step. Apart from that, the video files were a really helpful learning-by-doing approach, especially to solve the M6 exercises. Eventually, more information on the theoretical base of XML and GML and its terminology would have been handy when performing each step in the XML editor.
 3. Some of the URL's did not work anymore, for example for some of the papers of the M2 module (though, easy to find on the web), and a link to a UML tutorial.
- 13
1. The power point presentation themselves are clear but the multiplicity of the LINKVIT - files makes it difficult to understand the organization of the module. I would prefer one long file with a detailed table of content of each part and different exercises. Moreover some files are very repetitive.
 2. In general the exercises should give more trick to use Exercise 3 of M2 is not clear at

all I really did not know what to do until I read the solution.

3. In the GML file it useless to put so many examples Of code maybe a video showing those code and what they do is clearer (one Interactive example such as the correction of the exercise).

14 On module 2:

1. At some moments the information got me confused due to the frequent usage of sophisticated words. I wanted to use the recorded speech that was presumably in the module, but this did not work for me. I had to contact other classmates if I had any questions.
2. I felt that the article "Jakobsson A, 2003. User requirements for mobile topographic maps. Finnish Geodetic Institute." was partially out of the scope of this module. Perhaps a condensed version, or maybe a different article, could replace the current file.
3. The link to the following le did not work: "Boin A.T, Hunter G.J, 2006. Do spatial data consumers really understand data quality information? 7th International Symposium on Spatial Accuracy Assessment in Natural Resources and Environmental Sciences. Edited by M. Caetano and M. Painho."

On module 6:

1. The references to the wikipedia sites as an introduc-tion to GML was rather dull and not so interesting to read concerning XML/GML/SDI. The link given for the Open Geoconsortium Standard seems to point to the owner's computer, rather than a page on the internet. However, I was still able to download this document from the OGC page with the given title.
 2. Although the given websites were very educational and useful, they contained a lot of nested links. Tutorials referring to 'prerequisite background information', which contains more links,... This made the LINKVIT structure less clear.
 3. The tutorials of (<http://www.w3schools.com/>) were not as good as those of Brainbell, but were very useful after learning the basics, as they provide a lot of examples. I would suggest using this website as an example to further enhance your basics of XML, but not to start out with.
- 15 1. I sometimes felt like the Swedish lecturer of M2 & M6 was just going through his slides with little to no preparation about what he was actually going to say. So, with a lot of slides he was just reading what was already there on the slide, without actually adding anything useful to it. I also had the impression that he could make much better

examples to explain the accuracies. On the other hand, the Italian lecturer of M14 was very well prepared, but was clearly reading everything from a piece of paper, making it go very quickly and sometimes difficult to follow the first time.

2. The problems with the sound of the lectures can be very irritating after a while, especially in a lecture of over an hour.
3. Exercise 2 of the “Data Quality” module was not really clear for me. From the description of the exercise I really could not figure out what I had to do. Also in that area, some of the questions of the self-tests were not really clear.

Time

- 1 The total expected workload for the two modules together is 28 hours (12 hours for module 2 and 16 for module 6). During the classes, we worked approximately 6 hours on both modules. To keep up with the material during the academic year, another 2 hours was spend. I worked another 10 hours during the exam period to study the material and make all exercises. Another hour will be spend to repeat this material the day before the exam. This totals to 19 hours that were spend on the two LINKVIT modules. This is significantly less then proposed by the authors. I believe this is mainly due to the faster understanding of the material in class compared to individual learning.
- 2 The proposed amount of time that was suggested by LINKVIT was certainly not exceeded when completing the modules.
- 3 As far as the workload is considered I suppose that the estimates are correct. However to really read all the material given in the reading assignments one would need more time.
- 4 It is difficult to say how many hours I effectively spend on this modules, because I worked on it during different moments. However, I can say that I didn't need 12 and 16 hours to finish respectively M2 and M6, I think this is rather an overestimation.
During classes, we spend approximately 2 hours on both modules, to have a general overview of it, spread out over 2 different contact moments. This is just an estimation, because I don't remember it exactly anymore. For the individual study and exercises I needed approximately 8 hours for M2. For M6, I needed around 9 hours, but here I didn't do the exercises (I only have taken a look at the solutions) so probably another 2 hours would be needed if I would have done the exercises by myself. Finally, I think I need another 2 hours to study the theory of the modules as preparation for the exam.
If I sum up the hours of work, I can conclude that I needed 10 hours to finish M2 (1+8+1) and 11 hours for M6 (1+9+1, without doing the exercises).
- 5 The course Spatial Data Infrastructures was interesting but, at least in my case, more time consuming than expected for a 6 credits course. According to my calculations, there were 11 contact sessions. Assuming that each class took about 2.5 hours, it makes 27.5 hours. On this assignment I spent approximately 50 hours in total, from which about 20 was used for studying module M2 and 30 for module M6. Assignment 4 took me about 60 hours to accomplish. Unfortunately, I have not managed to complete assignments 1 and 3 yet. However, on the former one I already have spent about 50 hours. Preparation for the exam is not accomplished yet as well but I consumed about 10 hours so far on it. In total it all

makes 197.5 hours already spent on the course Spatial Data Infrastructures, while theoretically it should be 168 hours (1ECTS = 28 hours of study). Moreover, it should be remembered that assignments 1, 3 and preparation for the exam are not accomplished yet. However, it should be also taken to the consideration that I am a very slow worker and need more time to deal with some tasks.

6 About 4 hours was spent for Module M2 (estimated = 12hrs), although less time was spent on the lecture material as much of this was already seen in class. The M6 module took about 22 hours, much longer than the estimated 16 hours), due to the length of the tutorials & difficulty of the exercises. About 1.5 hours was spend on M14.

7 During the year I took the presentations of both modules and tried the exercises. Doing so, I spent less time on the topics then prescribed (12 and 16 hours). But combined with the time I needed for studying it, 12 and 16 hours might be a very good guideline for the student.

I can imagine that when you have to do the exercise without a video-solution, you spend much more time on it than foreseen. I always tried to make the exercises completely by myself, but I always got stuck quiet fast. Therefore, I often used the solution to make my own exercise which speeded up the process timewise.

8 The expected effort provided by LINKVIT for studying the modules was 12 hours for module 2 and 16 hours for module 6. I spent about a similar time on the modules as the given expected effort. Approximately 2 hours were spent in class on module 2 and also 2 hours on module 6. Then I spent 8 hours studying the materials at home and making the exercises for module 2. For module 6 this effort took about 9 hours. When preparing for the examinations it took another 2 hours to prepare module 2 and 3 hours for module 6. In total I spent 12 hours on module 2 which is exactly what LinkVit provided as an expected workload. On module 6 I spent 14 hours in total which is 2 hours less than the expected time. In general the expected workload that was given by LinkVit was about right. Definitely when we consider that my effort was just an estimation. I didn't use a timer when studying the modules.

9 For the M2 module I needed 11 hours to complete all lectures, readings, exercises and the self test. The exercises (mainly the first 2 exercises) took the most time. For the M6 module it took me 13 hours.

10 As can be seen, the time taken is well below the expected time necessary. This may be due to the fact that I had already encountered much of the material in my internship or previous courses.

11 I did not reach the estimated study time of both the M2 and M6 module, respectively 12

and 16 hours. For the M2 module, it would rather be 6 hours: about 2 hours for the lectures, 2 hours for the Excel exercises and 2 hours for reading the papers. Though I should remark that I only quick-scanned the R2 papers, as they were already mentioned in the L3 slides. Also, I solved the exercises step-by-step using the video tutorials, so there was no real slack time.

The M6 module took about 1 day (8-9 hours). For these lectures and online tutorials, I needed more time as the concept and its importance for SDI was rather vague to me. I performed the exercises as well using the video tutorials, which went quite smooth. However, I regularly had to look back to the theory to understand the meaning of each step.

12 The M2 took me a less more than 12 hours and the M6 also less than 16 but it's clearly estimation because I did not go through at once but during several weeks.

13 For the M2 module, in total, I spent more time than what was designed for that module. Instead of 12 hours, I clocked in at about 15 hours. For the M6 module I spent less than than the designed amount clocking in at about 9 hours. This is mostly due to the fact that I had already worked with XML and XML Schemas before.

14 M2 module – Data Quality: The contact session went fairly quickly in my opinion. I think I spent around 1h45 in total on those. The individual reading took me almost 4h30 in total (and I did not read the Jakobsen, 2003 yet). The exercises took me like 1h15, because I could not master to do all things in Excel that they wanted me to do. I watched all solution videos. So, in total: I spent around 7h30 on M2.

M6 module – XML and GML: The lecture took me a bit less than three hours to go through. The different tutorials in the individual study part were very long. I lost track of time, but I think that I worked for seven hours (or maybe eight) on these tutorials and the reading of the Wikipedia page (I skipped the one on map projections). I got kind of 'lost' in the exercise, so I ended up looking at the solutions after an hour for both. So in the end, I also was working on these exercises for over three hours. In total: I spent around 13 to 14 hours on M6.