D3.4: Report on educational strategy, year 2

WP3 – Future curriculum, education and training system

EUROPEAN UNION

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 771738

Document Information

Grant Agreement	771738	Acronym	NextFOOD
Full Project Title	Educating the next generation of professionals in the agrifood system		
Start Date	15/03/2018	**Duration**	48
Project URL	www.nextfood-project.eu		
Deliverable	D3.4: Report on educational strategy, year 2		
Working Package	WP3 – Future curriculum, education and training system		
Date of Delivery	**Contractual** 30/04/2020	**Actual**	30/06/2020
Nature	R – Report etc.	**Dissemination Level**	P - Public
WP Leader	NMBU		
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Executive summary

A new way of doing education will be important to cultivate the competences needed to deal with the challenge of sustainability in agrifood and forestry systems. Overall, the new educational approach is characterised by 1) a shift from theory to phenomenon and action as the starting point for the learning process ('experiential learning', 'action learning') and 2) a shift from knowledge to competence as the focus of the educational activities. The Nextfood project aims at contributing to these shifts by facilitating according to a master manual worked out by the project (deliverable D2.2) a transition to action learning in twelve educational cases in Africa, India and Europe. Simultaneously, research is done according to an action research protocol (deliverable D2.1) on the case transition process and on effects of action learning on students and involved stakeholders. The present report on the implementation of this educational strategy in the twelve cases focus on:

(1) the case development process (main challenges and supporting forces associated with implementation of the Nextfood approach)
(2) the students' experiences and learning outcomes (their development of key competences and transition to an experiential learning mode)
(3) benefits of involving non-university stakeholders (their learning outcomes and contributions)

The cases have collected data on the development and implementation of the intended educational activities. In a separate section of the case development reports (deliverable D2.6), the cases have been asked to report on how these data were collected, the analysis process, what the data indicate and whether there were any significant factors influencing the validity and reliability of the findings. These data form the basis for the findings reported in this document.

Data on the process of implementing action learning showed that a major challenge is to build an understanding of the need for interdisciplinary, systems-oriented, self-directed, group and peer action learning having as primary focus the training of key competences needed for sustainable development. To a varying degree this has been experienced in several cases with academic institutions, teachers, students and off-campus stakeholders involved in the education. This indicates a need for a shift in culture and mindset at several levels to remove the formal and practical obstacles identified and to create a favourable environment and motivation for a different kind of learning and assessment strategy. Although the reported challenges outnumbered the supporting forces, the latter included interest and support for systems-oriented action learning among institutions at various levels of governments and educational institutions and among individual stakeholders and commercial actors. Several scientific reports also strongly support the implementation of this approach.

Data from the students' self-assessment and information extracted from their reflection documents suggested a variable effect of action learning on the students' self-development of key competences. Possible causal relationships have not been explored so far, but it seems likely that the extent to which the action-learning approach has been implemented in a case, plays an important role. So do probably also factors such as pre-knowledge about and motivation for action learning among teachers, students and other stakeholders involved.

When it comes to students' transition in mindset and mode of learning, there was indication that reflection was valued as a competence on which development of all the others depend, and several students praised the effect improved reflection competence had on their lives outside university. In several cases, students that came into the course with expectations to gain certain pieces of knowledge or technical skills, gradually focused less on those aspects and more on developing the core competences. Further, several cases reported increasing enthusiasm about action learning among students, but also examples of students that had the same questions after the course as they had before. The causal factors for this variability are probably similar to those mentioned above regarding competence development but were not investigated.

Information about involving non-university stakeholders strongly suggests that they consider their interaction with students as useful learning opportunities enabling them to see their situation in different perspectives, that students were perceived as partners with important knowledge, and that the process of experience sharing worked in both directions. Similarly, their contributions are highly valued by course facilitators and students.

1 Introduction

A new way of doing education will be important to cultivate the competences needed to deal with the challenge of sustainability in agrifood and forestry systems. Overall, the new educational approach is characterised by 1) a shift from theory to phenomenon and action as the starting point for the learning process ('experiential learning', 'action learning') and 2) a shift from knowledge to competence as the focus of the educational activities (Fig. 1). The need for these shifts and the nature of cross-cutting key competences have been described in D3.1: Educational approaches.

The new action learning arena is basically the overlapping dialogue space where stakeholders from the educational institutions (students and teachers) and from society meet in a co-learning process ideally consisting of planning, implementing and reflecting on the transition of an agri-food or forestry case from the current situation to the future wanted one (Fig. 1). Notably, the process conducted on the action learning arena illustrated in Fig. 1 is basically the same as the master process conducted by Nextfood in twelve educational cases under transition to action learning (Figs. 2 and 3 in D2.2: Master manual draft 1).

As a result of such an intended transition (conversion), the students meet teachers and administrators that must facilitate another learning environment. How do the students adapt to and experience such an environment? What do the teachers do to support the transition to a different learning process? How do the teachers change?

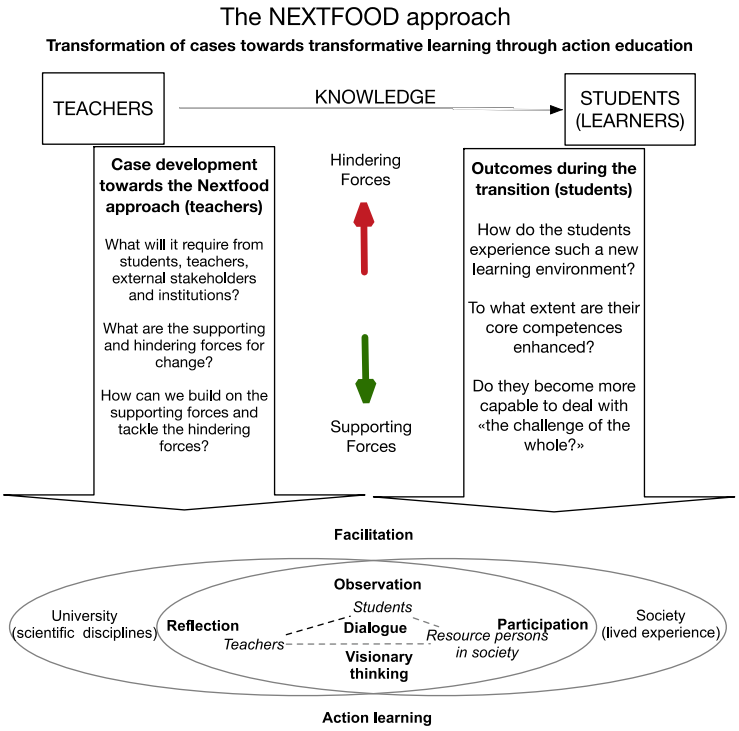

Figure 1: The Nextfood approach to transforming cases, showing the two main processes of case development and transition in educational approach.

In each phase of the Nextfood case development, several research questions are being asked (D2.1: Action Research Protocol). In this report, we will present results on topics pertaining mainly to the implementation phase, for which extensive data have been collected. The topics fall into the categories of

(1) the case development process (main challenges and supporting forces associated with implementation of the Nextfood approach)
(2) the students' experiences and learning outcomes (their development of key competences and transition to an experiential learning mode)
(3) benefits of involving non-university stakeholders (their learning outcomes and contributions)

2 Methods

The action research strategy employed in the Nextfood consortium revolves around twelve cases where the Nextfood approach to education is being planned, implemented and reflected on according to the overarching process described in D2.2: Master manual draft 1. All steps in this process are documented as described in D2.1: Action Research Protocol. The study of this whole process relies on a mixed methods approach where the case leaders document key stages of their course planning, implementation and reflection (D2.1), which they report on in the annual case development reports (D2.6–D2.8).

2.1 The Nextfood action research approach

Throughout the duration of the project, the twelve cases will implement the Nextfood approach as described in the D2.2 Master manual for case development and gather data as described in D2.1 Research protocol for research as well as case-internal development. The Master manual for case development (D2.2) describes an iterative, cyclical process for implementing and further developing the Nextfood approach. Ideally, each case should run at least one cycle of case development each year of the four-year project, seeking to improve the educational activities in the case and collect data on the process. Each cycle consists of three phases: planning, implementing and reflecting. The phases are further described in the supporting documents (D2.1 and D2.2). To assist and guide the case leaders in developing their respective cases, the NMBU team, leading the WP2 and WP3 work, have the role of facilitators for the implementation of the educational strategy at a consortium level. They provide support in the form of documents describing the development and research processes (the action research strategy), co-host planning and reflection workshops, and are a “help-desk” for the consortium partners who are responsible for developing each case.

2.2 Data collection

Following the research protocol (D2.1), the cases have collected data on the development and implementation of the intended educational activities. In a separate section of the case development reports (D2.6), the cases have been asked to report on how these data were collected, the analysis process, what the data indicate and whether there were any significant factors influencing the validity and reliability of the findings. These data form the basis for the findings reported in this document.

The preliminary data analysis performed by each case team was guided by two documents with instructions that were added to the research protocol (Appendices 1 and 2 in this document). One document describes how the case leaders should analyse text data and the other the process of analysing the numerical data gathered. Figure 2 illustrates the workflow of collecting, structuring and analysing data that was

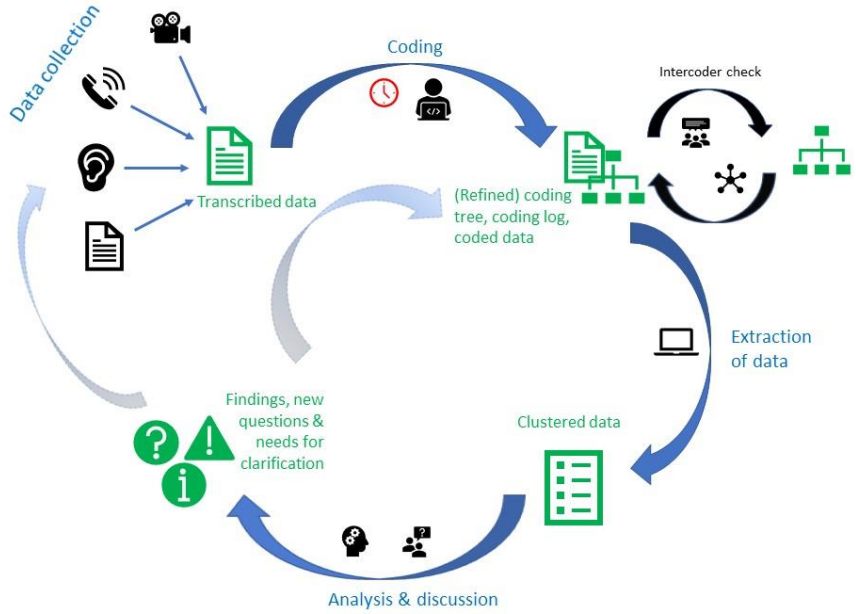

Figure 2: Workflow chart of collecting, structuring and analysing data in the action research processes used in the twelve Nextfood cases.

used by the cases. For this case work cycle, the main focus regarding the research process has been on the implementation phase of the case work. Regarding (1) the case development process, we here present findings on main challenges and supporting forces associated with implementation of the Nextfood educational approach as a synthesis of the case leaders' reports from what came forth during their workshops with participants such as teachers, scientists, students and agrifood and forestry stakeholders.

When it comes to (2) students' experiences and learning outcomes, we present findings on the students' development of key competences in the Nextfood model (observation, reflection, dialogue, participation and visioning). The presentation is based on the students' self-assessment at the beginning and at the end of the course and on their reflection documents written at the end of the course.

The students' perception of their development of the core competences was tracked by a self-assessment questionnaire where the learners were asked to assess on a scale from 1 (Novice) – 9 (Expert) their level of competence mastery on several statements related to each competence. The full version of the questionnaire can be found in Appendix 6 of the Research Protocol (D2.1).

In the students' reflection documents, we looked for instances where the learners described how and to what extent various educational activities have helped them develop the five core competences. The latter data source is represented mainly by cases that have already implemented the Nextfood approach to a great extent and that have emphasised the writing of a relatively comprehensive reflection document. In addition to information shared by the learners, in several cases, the course facilitators also shared their reflections on the action-learning process, and in-depth interviews or focus groups discussions with students and/or teachers have been carried out.

The information about (3) benefits of involving non-university stakeholders (their learning outcome and contributions) is based on comments from the main stakeholders in farm, food or forestry and reports from course facilitators.

2.3 Data analysis

To get an overview of the progress of implementing the Nextfood approach within and across all cases, the available data from the cases were used. We read the case development reports (located in D2.6) both in isolation (case-specific) and thereafter by topic (cross-case). As explained above, the action research conducted in all cases focused both on findings related to the case development process and on findings related to the outcomes of learning activities in the cases. Therefore, the data analysis for this document first focused on the data analysis section of the case development reports (D2.6), where the cases were instructed to report their findings related to the outcomes of the learning activities during the second cycle of case work. Further, the "status" sections in the case development reports were studied to supplement the preliminary findings generated, as those sections contained several useful reflections from the course facilitators. During the writing of this document, the authors of the case development reports were invited to share what they deemed to be the key findings from their reports.

3 Results

3.1 The case development process

The case development process was formally initiated during the first cycle of the case work with a kick-off workshop hosted by each case where the case leaders (often the main teachers of the course), students and other stakeholders participated and focused on how to implement the Nextfood approach. From the beginning, the twelve cases were at different points on the fictive scale from a traditional education approach to a full-fledged Nextfood approach, and in most cases, the development was about changing an existing course and not building a new one from scratch. Now, after the second year of the project, the case leaders have reported on the challenges of implementing the approach and on supporting forces. In the paragraphs 3.1.1 and 3.1.2 below, we present our thematic synthesis of what has been reported on from the individual cases.

3.1.1 Challenges associated with implementing the Nextfood approach

From the sources of information described above in the Methods section, the following list of challenges have been compiled:

- to build an understanding in academia as well as among stakeholders in society of the need for quality education and the value of self-directed, group and peer learning according to the Nextfood approach (dissemination of principles and results), i.e.:

    - to upgrade the value of conducting quality education in academic career development, as compared to scientific production
    - to obtain acceptance for focusing on the mindset and competences needed to deal with current challenges in addition to the factual knowledge
    - to obtain acceptance for seeing students as co-learners and dialogue partners, not only someone who needs to be lectured for
    - to communicate to stakeholders involved in action learning their role and the objectives and content of the process
- to create a vision for the adoption of action learning
- to set the objectives for the adoption of action learning
- to decide on its orientation
- to identify the faculty needs
- to provide training for the teachers in their new role as facilitators of action learning
- to overcome barriers between disciplines and obtain the transdisciplinarity required in a course based on systems inquiry
- to identify the students' needs
- to find ways to actively engage students in action learning
- to keep practitioners such as farmers and other stakeholders involved as learners or resource persons/co-learners throughout the course
- to overcome social challenges such as
    - language barriers
    - different expectations
    - misunderstandings among the students and between students and stakeholders involved in the education
- to solve practical problems such as
    - finding classrooms with a physical arrangement allowing flexibility, e.g., for working in smaller and larger groups
    - lab modernisation
    - effective use of the institutional farm
    - travelling of students and teachers to off-campus learning arenas or of resource persons to course campuses
    - large numbers of students per course
    - personnel shortage and limited budgets
    - Covid-19-related challenges such as restricted international student exchange and keeping of required physical distance during stakeholder participation and student group work
- to keep contributions from students' participation focused on and relevant to the process and content of the system inquiry
- to obtain meaningful feedback from the students
- to establish relevant procedures for assessment of this type of education and for evaluating and updating course syllabi
- to deal with a bureaucracy made for a different type of education
- to get institutional acceptance and sufficient resources for an assessment of the students' performance adapted to learning goals that to a great extent are different from traditional ones

3.1.2 Supporting forces for implementing the Nextfood approach

From the sources of information described above in the Methods section, the following list of supporting forces have been extracted:

- interest and support for (agroecology and) action-learning from
    - government (Norwegian Ministry of Education)
    - university leadership
    - individual teachers
    - students
    - individual stakeholders and organisations in society
    - farmers and commercial companies looking for collaboration possibilities
    - scientific reports on sustainability challenges and learning for sustainable development

3.2 Experiences and learning outcomes of the students

3.2.1 Students' self-assessment of competences

The data for the students' self-assessments of their development of core competences during the action-learning course have been presented in D2.6: Annual case development report (year 2). In summary, students in different cases seem to come into the courses with varying levels of confidence in their own abilities. Students at CIHEAM, UNISG and ISEKI gave themselves higher scores than students in the other cases.

Students in all cases reported improved competences after having completed their courses, however to a varying degree. Students at UNISG, ISEKI and AFS/IHU reported less progress than learners in the other cases. In the three cases where least self-assessed progress was reported, the difference between start and end the course is only significant at UNISG. All the cases with the least progress had high average values of self-assessment at the beginning of the semester, and thus the students did not have much room for improvement.

Students at University of Calcutta and Mekelle University reported a very large average progress. They both had lower starting points than other cases and thus the students had more room for improvement. However, both courses had few students, which may affect the reliability of the data.

Students at CIHEAM, NMBU and University of Kerala reported similar progress, with about two points increase per competence from the beginning of the semester to the end. In all these cases, the increase is statistically significant.

Visioning was, in all but two cases, the competence the students thought they improved the most. The two cases that did not have the largest increase in visioning compared to other competences, did not have a specific focus on developing the course. Apart from visioning, it is difficult to see a clear pattern across the cases.

3.2.2 Course impact on competence development

To assess the impact of a course in general and of specific educational activities on development of the five core competences, a number of cases have collected reflection documents from students and teachers or have done in-depth interviews or focus groups discussions with students and/or teachers. Analysis of those data, as per the process indicated in figure 2, has led to the following findings across those cases, structured per core competence.

Observation

Most students mention that they thought observation was a rather unnecessary competence to develop, but that they realised through the first educational activities that introduced the competence of observation that they had prejudices and assumptions that they wouldn't have become aware of without trying to observe neutrally (Norway). Those first educational activities included observation of a person eating (Norway), transect walks, observation walks followed by group sessions, field visits, and rich picturing (Kerala & Norway). Students realised that observation requires focus, concentration, presence of mind, active involvement, patience, and needs to be practiced (Kerala), in order to be a useful competence to fully understand a complex situation (Norway).

Dialogue

Students emphasise that they enhance the dialogue competence through working together with others (peers and stakeholders) during case work and in communication during interactive sessions in general (Kerala & Norway). In Kerala, students mentioned that facilitation plays and important role in building the competence of dialogue, while for students in Norway, reflection seemed to play an important role in the development of this competence, linking the theory of dialogue to practice.

Participation

Students' enhancement in the competence of participation mainly takes place during interaction with stakeholders while doing fieldwork and during group sessions (Kerala). When reflecting on educational activities that enable development of the competence of participation, students often describe also the development of other competences (Norway). Several students mention that participation enabled them to become better at dialogue and observation, and some students also mention participation helped to train the competences of facilitation and visioning. Therefore, it seems that students regard participation as a competence that allows for interaction with other competences.

Visioning

In general, students do not directly practice their visioning abilities throughout the courses in the same way other competences are practiced. Instead, it is in focus at a certain stage between observation and action planning in the system inquiry that forms the basis for the action learning (CIHEAM, Kerala & Norway). After an exercise or workshop on training of the competence, the students focus on facilitating a visioning session with stakeholders of their system inquiry (CIHEAM, Kerala & Norway). Both students and stakeholders have given mixed responses to the visioning sessions, ranging from very appreciative to rather indifferent or negative, which may suggest that

the competence is obtained to a varying degree. Notably, in one educational case, visioning was the competence least mentioned in the students' reflection documents, and most of the students' requests for clarifications and support were addressing visioning and vision development for their group report (CIHEAM). In another case, students felt that a lack of visioning was a major issue in public policy choices and took this as motivation for action (Kerala).

Reflection

Students in several cases describe how they have improved their abilities to reflect in a multitude of situations: in organised weekly reflection sessions (both teacher- and student-led), during case work, in dialogue with peers, at workshops, through individual reflective writing within course activities as well as in solitude outside course activities (CIHEAM, ISEKI, Kerala, Mekelle & Norway). In a few cases, students' reflection documents bear evidence —e.g., in the students' use of literature to make sense of and reflect on experiences or in reflection on own competence development— that the students at the end of the course have varying ability to reflect (Kerala & Norway). In one case, the analysis of focus group data from a course module showed that students had obtained a heightened ability to reflect mostly on "how" (meaning practical ways in which the action learning experience changed them) rather than on "why" action learning was a transformative experience for them (Greece).

Facilitation

In one case, students also reflected on their own experiences as facilitators. When doing so, they referred to difficulties they encountered in striking the right balance. For example, students mentioned that they experienced it to be difficult to abandon the participant-mode enough in order to be a good facilitator in a workshop for stakeholders. In spite of these difficulties, several students mentioned that they perceived facilitation to be a crucial competence that they would like to develop further. They also mentioned other competences in relation to training the competence of facilitation, more specifically dialogue and participation (Norway).

3.2.3 Learners' transition process

In several cases, students come into the course with expectations about certain knowledge and/or technical skills that they would like to gain during the course. But gradually, throughout the course, students in most cases focus less on those aspects and gain increasing interest in developing the core competences, along with increased enthusiasm about action learning. In Greece, for example, students focused entirely on training technical skills at the start of the course. At mid-term, students were involved deeper in action-learning activities than at the beginning and phrased their answers to interview questions more in relation to action learning. At the end of the course, they did not focus on technical skills anymore, and focused entirely on competence development. Also in other cases, at the end of the semester, many students had to admit that they still had some of the same questions as coming into the semester (Czech Republic, Norway). However, many pointed out that they got answers to questions they did not know they wanted to have answers to, such as how to lead a visioning workshop, how to reflect, and how to effectively work in groups; and

they pointed out that the course was more about personal development than learning about agriculture systems (Norway). Indeed, most students had become very enthusiastic about the action-learning approach throughout the course despite not having gained the knowledge that they were expected to gain in the course (Calcutta, Czech Republic).

Furthermore, several students praised the impact their improved abilities to reflect have had on their life outside school as they felt more able to connect their goals to their action steps (Norway). Substantiation for these improved abilities can be found when comparing the questions that students ask themselves at the beginning and at the end of the course. At UNISG, the difference between questions could be interpreted as students' transformation from being passive learners to becoming players within agri-food systems that are willing to improve those systems. Students expressed their willingness to participate and at the end of the course, they were wondering how to imply themselves into the agrifood systems in order to be useful and efficient parts of the systems. Also in Ethiopia, the tendency in the 1st cycle showed that students were transitioning towards a different kind of questions such as questions about career development, sustainability, integration of actors and disciplines, systemic view, participation and learning issues towards the end of the course as in comparison to the beginning of the course However, this was not observed in the second cycle of the Ethiopian case. Then, the students themselves mentioned that the group composition (only 3 students) was too small to enable them to explore and experience the action-learning process to the fully. Moreover, students not speaking the language of stakeholders, and disciplinary background of students, was reflected upon by the teachers as potential additional hindrances to students' full engagement in action learning.

3.3 Benefits of involving non-university stakeholders

Engagement with local communities and integration of courses into local agrifood systems should be an important part of action-oriented educational programmes. Here, the Nextfood model seeks to facilitate and promote co-creation of knowledge between students, teachers and stakeholders (e.g., farmers). Arriving to this ideal state requires high motivation from all parties involved and a clear perception of the benefits coming from co-learning processes. Whether the actors involved perceive the case activities as a personal learning opportunity and how this integration can be shaped in practice, will be shed light on in the following practice examples.

At CIHEAM, the past Nextfood cycles have generated understanding of the usefulness of using one of the local agrifood actors with well-established networks as the "main actor" during case study implementation. This role can be played well by some kind of "umbrella" organisations such as cooperatives, associations, local action groups focused on territorial development, etc. Inclusion of a local agrifood actor has proven to be very beneficial to reduce the time and efforts needed in the planning of the course, since the main actor allows for building on already established networks and gives the students a higher level of trust from the local communities when entering the case study process.

Similarly, this approach of engaging an umbrella organisation as main stakeholder, has enabled CIHEAM to focus on the territorial level, thus presenting the students with a learning arena with a potentially higher impact on society, compared to for example engagement at farm level. The territorial level presents the ideal environment for involvement on sustainability issues, giving the possibility it provides to the students to propose concrete solutions for local communities. At the same time, this process highly depends on local stakeholders who are involved as key informants and active participants in problem solving.

Stakeholders' role is crucial for students to holistically understand the problems at hand and to approach them from different dimensions of the territory (i.e. environmental, cultural, social, etc.), while continuous interaction with students and teachers makes the stakeholders co-creators of knowledge and of solutions that have the potential to increase sustainability of the local agrifood system.

Through its case study implementation, CIHEAM recognised that continuous dialogue and frequent on-site visits to stakeholders create team spirit among all persons involved and contributes to their wish to arrive together to high-quality outcomes for the project. However, an important factor for this process to be successful, is that the institution implementing the case study opens its doors for stakeholders as well, inviting them for students' presentations, workshops, etc. and thus provides them with a direct opportunity for knowledge transfer and cross-fertilisation of ideas.

At CIHEAM, diversity among the stakeholders involved (i.e., farmers, processors, members of cultural associations, restaurants, etc.) has promoted multifaceted solutions and created a sense of community around the students' case study. When the students' final projects where presented to all actors involved, they were emotionally moved since they saw the results of having taken part in the process with their personal contributions. at the same time, this approach allowed students to present concrete multi-stakeholder partnerships for the targeted local problems. Further, ideas coming from the students were highly appreciated and all stakeholders expressed strong motivation and will to start with their implementation. This is believed to represent an important sign of stakeholders' learning.

In Ethiopia, similar observations were made during the second cycle of the Nextfood case. Farmers explained the usefulness of the students' work for them in terms of its mutual learning opportunity. One Ethiopian farmer explained the importance as follows: "What is presented here by the students is correct information. The gap identified is also true. I need to plant fruit trees instead of planting Eucalyptus only that I inherited from my parents. I learned this in this meeting".

Also in the Czech Republic, students' work was positively evaluated by the stakeholders involved, namely workers of the social enterprise Arpida. Students suggested improvements of gardens in accordance with social farming principles were realised, and structures proposed by students were built. In sum, students were perceived as partners with important knowledge and the process of experience sharing worked in both directions.

In 2019 at UNISG, a new Master's programme (Master in Agroecology and Food Sovereignty or MAFS) was developed within the frame of the Nextfood project.

UNISG organised two co-creation workshops (in February and May 2019), involving different stakeholders in the idea generation process. Thus, the process and contents of MAFS are the result of joint ideas provided by UNISG academy, the Nextfood partners, current and former UNISG students, PhD-students, and other relevant stakeholders such as representatives of Slow Food, territorial coordinators of Terra Madre communities, agri-food journalists and leading professors of Agroecology.

The programme is based on an experiential learning approach and supervised action-research in Slow Food Terra Madre communities, combined with farming or gardening activities, lectures and seminars on campus. Besides, the MAFS aims to create a worldwide network involving students, farmers from Terra Madre Communities around the world, Slow Food and small-scale Italian farmers. Strong connections between UNISG, Slow Food and different stakeholders is a supporting force to the programme as well as to the Nextfood project because it enables the involvement of stakeholders into project workshops (for WP1, WP3 and WP4) and into education processes, particularly didactic study trips.

Direct participation of the farmers from Terra Madre communities in the education process is envisaged as the central and essential part of the Master's programme. For three months, the students will carry out research, thereby using the core competences and actively contributing to rural life of each community.

Social factors such as language barriers, different expectations or misunderstandings between the students and farmers could be considered as potential hindering forces for involving stakeholders into the education process. In order to minimise risks related to these social factors, the Master's programme includes a process of matching the students and Terra Madre communities. Besides, the appropriate documents (Guidelines for the Terra Madre communities) will be developed by the UNISG team. The Guidelines will clarify the objectives of each MAFS phase to the farmers, and roles of the farmers in the education process.

Other external factors such as international events organised in Bra (where UNISG is situated) are considered as supporting forces for the MAFS, and for the Nextfood project in general. The events (CHEESE, TERRA MADRE and Slow Fish) organised by Slow Food, allowed for dissemination of information among interested people, recruitment of new students and involvement of new stakeholders.

A last but no unimportant supporting force for the development of the MAFS is its thematic. Issues pertinent to agroecology and food sovereignty seem very interesting for the students' research, and the combination of those issues with and action learning approach seem to generate curiosity amongst several agri-food activists which makes them interested to participate in the programme.

4 Conclusions

Data gathered from the twelve educational cases in the Nextfood project on the process of implementing action learning showed that a major challenge is to build an understanding of the need for interdisciplinary, systems-oriented, self-directed, group and peer action learning having as primary focus the training of key competences needed for sustainable development. To a varying degree this has been experienced in several cases with academic institutions, teachers, students and off-campus stakeholders involved in the education. This indicates a need for a shift in culture and mindset at several levels to remove the formal and practical obstacles identified and to create a favourable environment and motivation for a different kind of learning and assessment strategy. Although the reported challenges outnumbered the supporting forces, the latter included interest and support for systems-oriented action learning among institutions at various levels of governments and educational institutions and among individual stakeholders and commercial actors. Several scientific reports also strongly support the implementation of this approach.

Data from the students' self-assessment and information extracted from their reflection documents suggested a variable effect of action learning on the students' self-development of key competences. Possible causal relationships have not been explored so far, but it seems likely that the extent to which the action-learning approach has been implemented in a case, plays an important role. So do probably also factors such as pre-knowledge about and motivation for action learning among teachers, students and other stakeholders involved.

When it comes to students' transition in mindset and mode of learning, there was indication that reflection was valued as a competence on which development of all the others depend, and several students praised the effect improved reflection competence had on their lives outside university. In several cases, students that came into the course with expectations to gain certain pieces of knowledge or technical skills, gradually focused less on those aspects and more on developing the core competences. Further, several cases reported increasing enthusiasm about action learning among students, but also examples of students that had the same questions after the course as they had before. The causal factors for this variability are probably similar to those mentioned above regarding competence development but were not investigated.

Information about involving non-university stakeholders strongly suggests that they consider their interaction with students as useful learning opportunities enabling them to see their situation in different perspectives, that students were perceived as partners with important knowledge, and that the process of experience sharing worked in both directions. Similarly, their contributions are highly valued by course facilitators and students.

Appendices

Appendix 1 – Instructions for analysis of text data

Instructions for data analysis – Text

Version 2.0

As mentioned in the Research Protocol (D2.1), rigorous data collection and analysis is paramount to the success of the action research in the Nextfood project. In order to ensure consistent data collection, the Research Protocol provides instructions on how to collect data from the activities performed when following the Manual for Case Development (D2.2). Once the data have been collected, they need to be analysed in a consistent and rigorous manner in order to allow for fact-based improvement of each case and for cross-case comparisons. Our aim is therefore to provide you with clear instructions on how to analyse the data that you are collecting throughout the activities in your case.

With the instructions provided in this document we aim to support you in analysing the data that you have collected in the form of text or that can easily be turned into text. We have developed these instructions for you to analyse text qualitatively through the method of Content Analysis. This is a well-established method which we will guide you through one step at a time. You don't have to be experienced in qualitative research to work with this document, but you should be acquainted with the Nextfood approach.

Given that Content Analysis is the method we are using, let's start with looking at what that method is all about.

Content analysis requires (1) starting with research questions that you want to find answers to; (2) creating a set of codes for categorising the text; (3) applying those codes systematically to a set of texts; (4) testing the reliability of coders when more than one applies the codes to a set of texts; (5) creating a unit-of-analysis-by-variable matrix from the texts and codes; and (6) analysing that matrix […] (based on Bernard 2006)

1) The research questions in the Nextfood project are situated at two levels: 1)The students' learning and experiences in the new learning landscape, and 2) The process of changing the learning landscape (the course activities) towards the full-fledged Nextfood approach. (re. the areas of shift)
2) We have already created a set of codes for themes in the research questions based on the Nextfood model, the so-called coding tree.
3) In this document we will describe how to apply those codes systematically to your data that are or can easily be converted into text.
4) We will also describe how you can do an intercoder check in which you test the reliability of several coders.
5) We will describe how to cluster data and create units of analysis, potentially using qualitative data analysis software.
6) We will explain you how to analyse those units qualitatively.

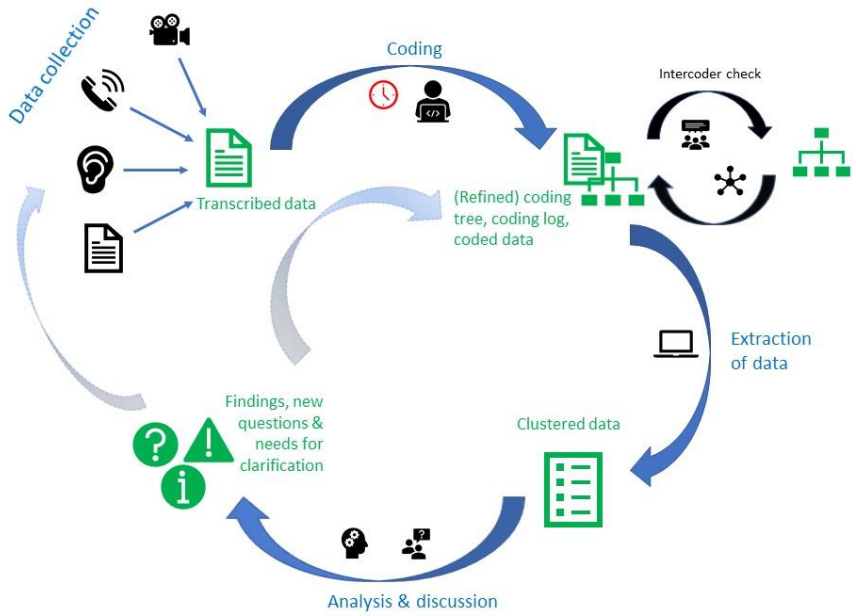

Figure 1 Overview figure

Figure 1 shows the different steps that we will guide you through in this document. Starting in the upper left side of the figure and following the arrows clockwise, this document will guide you through the following steps: You have collected the data and should make them ready for analysis first. This means that you should **transcribe** some of the data. You should then **code** your data. Be aware that this is a time consuming and concentration demanding process! Moreover, coding your data includes doing **intercoder check(s)** if several persons are coding, which is also a tedious task. Once coded, you should **cluster** your data through several **extraction** processes. Next, you can start **analysing** your data, which means looking at what your data indicates thanks to the coding and clustering you have done. The analysis leads to an understanding of the meaning of the data and at this stage you are ready to write the Case Development Report.

This document will guide you through these different steps. Each step is represented in a section that starts with a visual representation of that step as well as a box that mentions who is best suited to conduct the step and what material to start and end with. Then, each section describes what you should do based on examples from the NMBU case and with reference to previous Nextfood deliverables and scientific literature when necessary.

TRANSCRIPTION: Preparing your data for analysis

Figure 2: Visualisation of the transcription phase of data analysis (excerpt from fig. 1)

WHO?	Anyone (who can read and write, is meticulous and able to translate to English if necessary)
START WITH	Data in the form of text files, video files, audio files
END WITH	Data in the form of anonymised text, filed in line with the guidelines

Transcription is the process of turning your audio recordings/assignment responses/notes/video recordings or other raw data into a text document that you can further code. If your data already is in the form of a text document, this step is mainly about anonymity, storing and possibly translation. During this process you should anonymise the data, and store the data using the correct structuring syntax (in line with Nextfood's D6.2: Data Management Plan). Preferably you should also translate the data during this process. However, if you have very large data sets, which would make the translation time-consuming, or if you are worried that during translating you lose a lot of the content, you may also opt to transcribe and code in your local language and only translate those parts that you would like to use as quotes when describing your results.

Transcription begins by creating a new text document and naming it using the syntax explained in the box below. To do that there are several structuring decisions you have to make regarding naming the datasets, subsets etc.

Explanation of the naming system and rationale

From D6.2 p.11:
"WPNumber_TaskNumber_PartnerName_DataSubset_DatasetName_Version_DateofStorage"

To accommodate for the multiple similar datasets that will be made throughout the cycles in the cases, we decided to add a naming category, which makes our naming system follow this structure:

WPNumber_TaskNumber_PartnerName_**CycleYear**_DataSubset_DatasetName_Version_DateofStorage"

Rationale:
WPNumber = WP2 because that is where the cases have funds in the project

TaskNumber = T2.2 because that is where the case development reports stem from

PartnerName = NMBU

CycleYear = 2019 because that is the year the course ran.

DataSubset = Exercise 1 because it is the subset of the dataset gathered.

DatasetName = Beginning of semester because it is the dataset which includes the particular data file

Additionally, you have to make an identification key that links the participant's[1] name with an anonymized code. This identification key must not be kept together with the transcribed data. As a suggestion, you print out a list of all the participants, assign a randomized code to each participant and circulate the list physically among only those who will do the transcription work. Do not share this key online, even amongst the team. Thereafter, you should start the transcription by writing short and descriptive meta-information for instance like this:

[1] In this document, we use the term 'participant' for all persons from which this project generates data, to name a few: students, teachers, stakeholders, participants in focus group discussions.

Content:	End-of-semester interview regarding learning outcomes
When/where:	NMBU 2019
Data type:	Audio recording
Interviewer:	Åsmund Steiro
Transcriber:	Åsmund Steiro
Participant-ID:	390
Structure:	I: Interviewer
	P: Participant

Now you are ready to transcribe the contents. There is no need to write down all the "uuh"s and "eeehm"s, but the transcribed data should stay close to the wording of the participants. It is however not necessary to transcribe everything that is being said in a conversation. If a part of the interview is clearly not relevant for the further analysis, it is better to not spend time transcribing and coding it. For instance, if the interview digresses and the two people start talking about the recent weather patterns, it's appropriate to mark the transcription with a timestamp of when the digression started and ended and then indicate the contents of the digression with a short description. For instance, you may write "13:30-15:30: [Talked about the weather]". While transcribing, any information that might compromise the identity of the participant must be anonymised. For example, if a student reveals their hometown, age, their name, a classmate's name or any other identifying information the transcriber should substitute the identifying text with for instance [age] or [name of classmate]. If you decide to translate non-English information to English, you may find it most convenient to do that while transcribing instead of in two separate operations. If the transcriber is uncertain about a translation, s/he should include the original phrase and the interpretation, indicated by [square brackets] where necessary.

The most classic type of transcription is writing down word by word the contents of an audio recording. However simple that task sounds, it should not be taken lightly as it is very time consuming. If you have a lot of data that needs to be transcribed, you should consider hiring extra help from for example a graduate student as the task does not require much knowledge of the project.

If you decide not to transcribe your data, or if your data are already in English, you should nevertheless anonymise the data.

CODING: Structuring your data

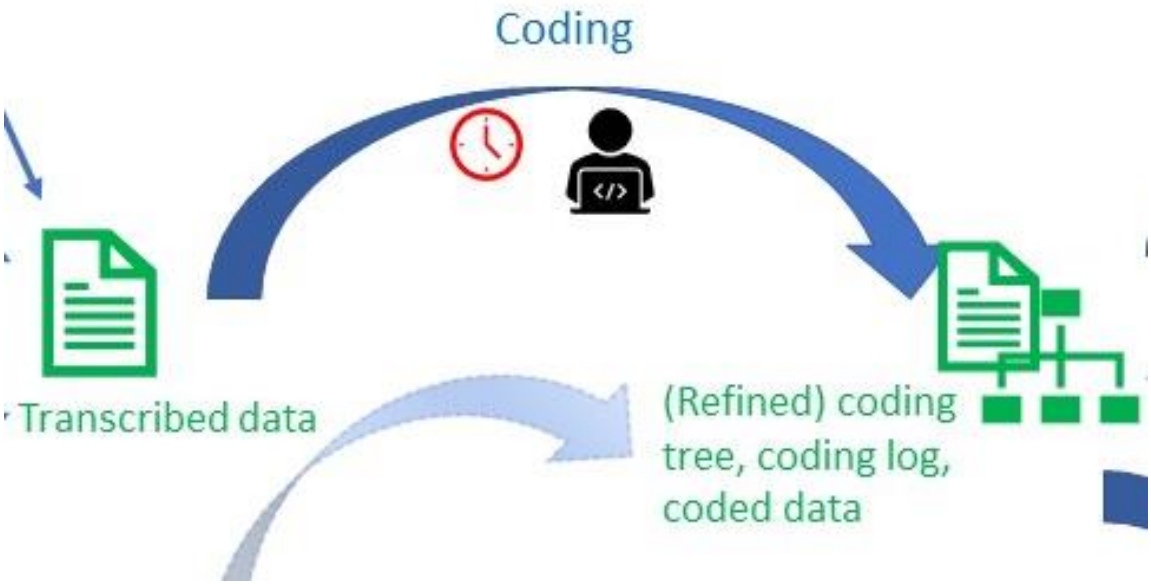

Figure 3: Visualisation of the coding phase of data analysis (excerpt from fig. 1)

WHO?	Researchers who are familiar with the Nextfood approach (case leaders)
START WITH	Data in the form of anonymised text, filed in line with the guidelines
END WITH	Data coded individually by one or several coders,

Coding individually using a predefined coding tree

After having collected and prepared your data comes the task of sieving out what is interesting in the data. This is essentially what coding is. We have developed a coding tree (figure 4) that every case should use as a sieve. In practice, this means that you read through data and select parts of the text and tag it with a code if that text is related to that particular code. Examples of coding below will make this clear. Coding is a time-consuming task and requires good understanding of the research questions and the Nextfood approach and we therefore believe it is best if researchers familiar with this (i.e. case responsibles) carry out this task.

The coding tree has been developed to structure the data. More specifically, to structure the data in a way that makes it easier to answer the research questions that we ask ourselves during the implementation phase of the case work. You might remember those questions from the research protocol (D2.1). We also repeat them below. As stated in the introduction of this document, we're investigating these questions at two levels: 1) The students' learning and experiences in the new learning landscape, and 2) The process of changing the learning landscape (the course activities) towards the full-fledged Nextfood approach.

At this point in time, we focus on the first level since that is the level to which the material we are coding now is related. Indeed, we are now coding data that were generated by students. The second level will be dealt with in the analysis of the planning/reflection workshops.

More specifically, the questions we're looking to answer by analysing data from the implementation phase is (from the research protocol, p. 11):

How do students experience such a learning process in terms of

- *how they adapt?*
- *what it requires from them?*
- *what it gives them?*
- *what is missing?*

How and to what extent do various educational activities enhance the students' abilities to deal with 'the challenge of the whole', including to take or facilitate informed action, and the competences considered necessary for doing so (observation, reflection, dialogue, participation and visioning)?

The first questions are best answered by using a data-driven approach where we explore how learners describe experiences with the "new learning landscape". Conversely, the second question should be answered by a more concept-driven approach where we look for instances where the learners describe how and to what extent various educational activities have helped them develop the six core competences.

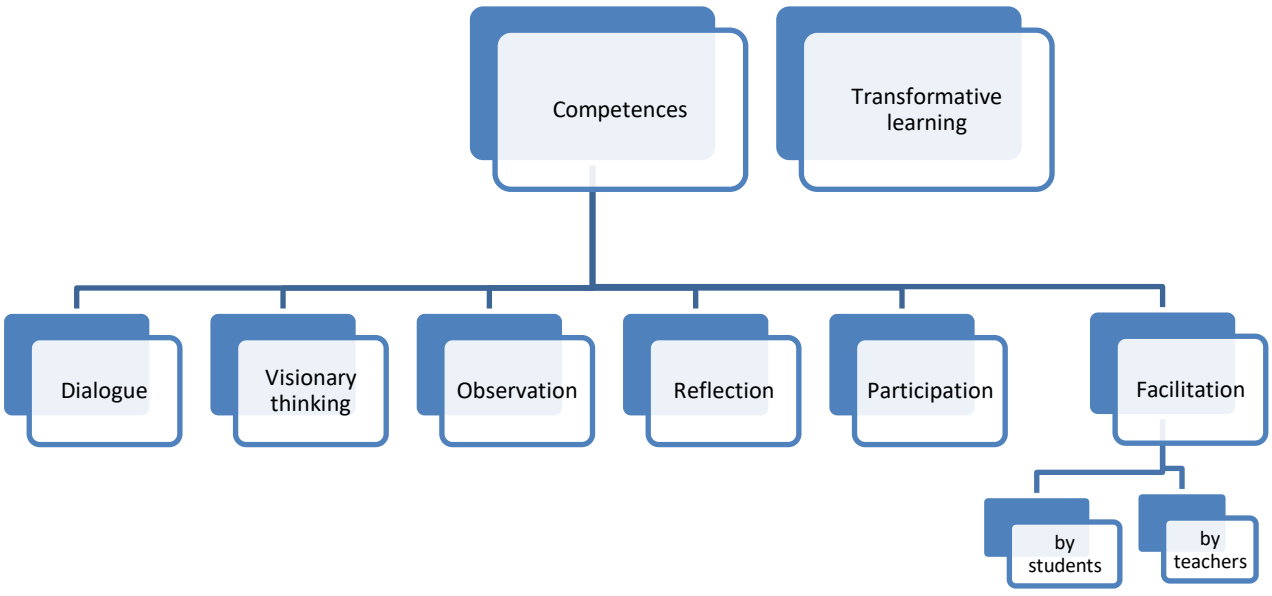

Figure 4: The coding tree

As shown in the figure above, the coding tree begins with two branches: competences and transformative learning. Competences then branches further into the six core competences that we have placed a heavy emphasis on in WP2. Finally, the competence facilitation branches into students and teachers to distinguish between facilitation done by students and by teachers. These ten codes are the primary codes to be used when coding the text data, however, we encourage each case to add additional codes if you feel it is necessary. Be advised that for each additional code added, the task of coding becomes more challenging as the coder has to consider a larger number of themes to look for in the text data.

Qualitative data analysis programs can make this job easier. In the NMBU case, we use NVIVO 12 Pro (QSR International 2019) and we recommend all cases to use this software too because that will make it easy to share coded data and do cross-case comparisons. Throughout the rest of this chapter we will explain how the codes in the coding tree should be assigned to the data you have collected and prepared for coding.

How to use the coding tree

There are two categories of formulations from your transcribed data regarding competences that should trigger coding them; (1) where participants describe **their own** actions or experiences related to competence development during, or in relation to the course; (2) where participants describe **others'** actions or experiences related to competence development during or in relation to the course. Sometimes the participants explicitly mention the competence they or others developed, and then it is easy to know which competence to code for. However, often participants describe actions or experiences where they developed competences without explicitly referring to the competence. In such cases, you should try to assign a suitable competence code based on the definitions and examples in the following sub-sections.

The competences are pre-defined concepts that we instruct you to code for, while "transformative learning" is a more data-driven code where we encourage you to not feel constrained by the theoretical concept of "transformative learning". For an explanation of how to use the code "transformative learning", see the sub-section below

Depending on the data type you are coding, you will probably find more of certain types of statements. For instance, when coding reflection documents where students are describing their learning process, you should look for text where students describe actions that relate to developing competence(s) or transformative learning that took place during the course or when they refer to such actions when describing their own future plans. You should not code text where students describe actions that took place before the course. After all, you are coding the reflection documents to gain insights into how competence development and transformative learning happens **during** or **because of** the course. However, when coding students' answers to the questions that you ask them at the start of the course, you should also code text where students describe actions that took place before the course because that's the only thing students can refer to at that point in time and you code those answers precisely because you want to gain insight into their evolution over time (by comparing their

answers before, in the middle and after the course, as well as comparing those answers with what they write in their reflection documents)

Be aware that you can also code "negative examples" where participants describe a failure to develop the competences or expresses the need for an increased level of competence development at a certain point in time, during a specific activity, or in general. (See examples 3 and X below.)

Let's look into examples for how to use the different codes in the coding tree.

Competences includes the six core competences of the Nextfood project, but also all other competences that do not have an explicit code in this coding tree. The definition proposed by Wiek et al (2011, p. 2014, referring to others) is useful in that regard:

We employ in this article the definition of competence as a functionally linked complex of knowledge, skills, and attitudes that enable successful task performance and problem solving (cf. Spady 1994; Baartman et al. 2007).

A competence is thus not synonymous with a skill. To be competent, one has to combine knowledge, skills and attitudes to enable successful task performance. And in this context, the successful task performance is related to improving the sustainability of our future farming and food systems. When coding for competences, we encourage you to keep this important distinction between skills and competences in mind. It may become clearer to you by reading the examples below.

This particular code (**competences**) should be applied to text where competences in line with this definition are mentioned, and are not captured by either of the six core competences of Nextfood. In other words, you should use this code when you have the impression the text describes competence development, but you cannot put your finger on which competence exactly. Let's move on to see how we intend to code the six core competences.

Participation is defined in D2.1 and D3.1 as follows:

Participation is the competence of participating in work in the field, not as a distant observer, but rather with personal commitment and dedication in interaction with different stakeholders.

By "in the field" we mean any learning arena outside the traditional academic arenas. For instance, this could be participation in farming/forestry operations, participatory classroom sessions, stakeholder workshops, or other forms of systems inquiries. See example 4 below.

Further (D3.1, p. 15),

"participation can be interpreted as a transformative process focused on making a difference, as opposed to accepting status quo."

Therefore, it is not enough to simply be present in the learning arena. In this context, participation refers to interactions with the stakeholders with the aim of changing the system. We'll provide some examples to demonstrate how we should use this code:

Example 1: **participation and reflection**

Participant: *"First, both caseworks were safe experimental spaces that offered good examples of how participation helps build trust between people who do not know each other but are brought to work together towards a higher purpose. They also allowed me to assess and reflect on the value of participatory inquiry processes as we conducted them."*

The participant is describing that the caseworks, which are essential parts of the course, enabled her/him to improve their competence in participation and reflection. In this example there is a clear causal suggestion from the participant. It is clear from this quote that it was the situation in the caseworks that enabled her/him to improve their level of competence mastery. This is exactly the information we are after in coding the reflection documents and a clear example of the first category: the participant describes her/his own experiences during the course where competences were developed.

Example 2a: **Participation**

Participant:

"At the first two schools, we were only able to speak with administrators, and didn't really get an idea of the canteen managers' point of view. The third school provided us the opportunity to do so, and this canteen manager turned out to be the greatest well of knowledge. We realized from our interview with the canteen manager at the third school that canteen managers seem to be the main catalyst for success in this project. Implementation of the goal runs through them. Therefore, we attempted to set up more

Example 2b: **Participation**

Participant:

"Participation on both farms included potato harvesting, cleaning out the barn, pulling up electric fences and changing tractor tyres. This work allowed for an appreciation of the typical daily scenarios of the farmers. This took place over several hours which gave us the opportunity as a group to talk quite constructively about what the situation was here on each of the farms."

Explanation

Example 3: **"negative example" of participation**

Participant:

"When we came back for the visioning workshop on our second visit on the field, we presented our rich picture to the participants and asked them for feedback. This way, our data, interpretations and conclusions could be tested by field actors who could challenge our findings and point out discrepancy. However, most of the stakeholders we interviewed to analyse the food system and construct our overview of it where not those who were present at the workshop. So we could not really make sure we were representing the initial participants' view."

Visionary thinking is defined in D2.1 and D3.1 as follows:

Visioning is the process whereby we activate our insight and imagination, connect with our values and sense of purpose and create mental images of a desired future state. Being able to engage a group in creating a shared vision can heighten the possibility for breakthrough solutions and unite and provide the link between diverse people, interests and activities.

When applying this code you should look for instances where participants describe actions related to envisioning a desired future for a system they are interacting with. This may for instance be co-developing a plan for farm improvement with a farmer. However, it is important that the desired future is not just a quick-fix to a technical problem, but that it has an element of activating insight, imagination and connecting with values. The term should not be conflated with problem-solving as visionary thinking encourages thinking about a desired future and not focusing on the problems.

Example 4: **Visionary thinking**

Participant: *"I was thoroughly impressed with the farmers abilities to get into the visioning session that we held with them. Initially we did not think it would be appropriate or possible to convince them to feel 'safe' in closing their eyes and imagining. We were keen to give it a go and I led the script with helpful support from the rest of the group. It was beneficial for the group members to also take part in the session and help with further idea generation and probing as we tried to then get the thoughts on a mind map."*

Explanation

Observation is defined in D2.1 and D3.1 as follows:

Observation is the competence of carefully examining situations in the "world out there" with which you are confronted, before you make any judgements about the situation. This has the intention of an unbiased examination.

Furthermore, to be a good observer you have to be aware of your potential biases. For instance, if a student with crop science background visits a farm, s/he will have a bias towards observing the crops at the farm. The good observer is aware of those biases and doesn't try to ignore those perspectives, but rather seeks to look beyond as well. When applying this code you should look for instances where this mode of exploration is described in relation to the case activities.

Example 5: **Observation**

Participant: *"After the observation of a situation, we were asked to draw a rich picture; it was something I had never tried before. Drawing a rich picture is a group exercise that helps to understand the complexity of an entire situation by the illustration of different perspectives. The main idea is to think holistically about what we've seen and try not to structure. It's about understanding relationships and connections without representing the organization of the system. It was difficult for me not to give structure to our rich picture. However, I understood, step by step that structure does not mean cohesion and that it's possible to represent a messy situation in a clear way."*

Reflection is defined in D2.1 and D3.1 as follows:

Reflection is a process of exploring and examining ourselves, our perspectives, attributes, experiences and actions and interactions. It helps us gain insight and see how to move forward. It increases our ability to link our own experiences to theory and to personal development.

The key to coding for reflection is to look for instances where the participants describe improving their abilities to reflect or that they practiced the ability of reflection. For instance, phrases similar to “this experience made me realize the value of connecting the insights from concrete experiences and theory”. We’re not looking to code reflections per se. So if a participant is stating that “As I am a person who needs frequent feedback to do well, the amount of peer-feedback was very beneficial for me.”, the statement itself is a reflection, but should not be coded for reflection as it does not describe how the participant improved their abilities of reflection. It should also be noted that reflection is not the same as feedback or evaluation.

Example 6: **observation and reflection**

Participant: *"Drawing a rich picture with the group helped me to practice my observation competence. The aim of the rich picture was to draw all the observations and information made during the working day and interviews. I found that exercise challenging because it forced me to just draw what I observed, the challenge was in that I was quickly jumping into system analysis without exploring all the observation phase. Thanks to this exercise I understood that if I want to have an overview of a whole complex situation, I need to take the time to observe before I jump to system thinking and other conceptualization reasoning. I also think that this understanding was part of being an autonomous learner thanks to the reflection I had about that experience. "*

Explanation

Dialogue is defined in D2.1 and D3.1 as follows:

Dialogue is a process which helps us notice the nature of our thinking. Dialogue increases our capacity to move into and toward difficult issues in a welcoming fashion. It expands our capacity to listen and to become aware of the piece of the mosaic that might be missing from our own and the collective understanding.

A dialogue is a form of conversation, which as opposed to a debate, is focused on understanding each other, learning from the conversation and gaining a higher understanding than one could have by oneself. People who are good at the competence of engaging in dialogues are able to reflect together in this form of conversation. When you code text for this competence you should look for instances where the participants describe experiences with this type of conversations in relation to the case activities.

Example 7: **dialogue and reflection**

Participant: *Firstly, the dialogue, thanks to the theory I knew what the characteristics of the dialogue were. I observed that in our group there was at some points an unwillingness to be influenced and an absence of active listening as it seemed that we were thinking about an answer while the other person was talking. An example of it was when we tried the talking stick, which was a good idea towards being interrupted by the other members of the group while explaining ideas. It turns out that as soon as the person finished everybody directly wanted to take the parole and have the stick, in that could see the absence of at least a short assimilating phase before answering. It seemed that everybody had already an answer to what was said. Thanks to these observations I experienced that the mindset of the individuals in the group was something very important towards having a good dialogue. "*

Explanation

Facilitation is defined in D3.1 (p.13) as follows:

Facilitation is the ability to enable others to cultivate the other five competences.

Pierce et al. (2000) established a facilitator competency model describing key aspects of what a competent facilitator should be able to do. We recommend that in order to gain a good understanding of what facilitation entails in this context, read the “Pierce paper” in addition to the chapter in D3.1 (p. 21) describing facilitation in education.

Example 9: **facilitation (by students), dialogue, participation, visionary thinking**

Participant: *"When we have been explained the process of how we may conduct our farm case. I had doubts about it, it was very abstract and new for me because of the reason explained above. But once I started doing the visioning session and the action planning session with the farmers, I understood how this approach was powerful. The farmers had ideas about what they wanted to implement in their future. They had the resources as well to make those ideas possible. We just helped them to identify what values were behind those ideas, how to organize them and bridging the abstract world (ideas and not concrete plans) with the real world (making an action plan in order to start implementing those ideas). "*

Explanation

Example 10: **"Negative case" of facilitation (by teachers)**

Participant: *"In addition, lectures and readings provided me with tools that I believe can be very helpful when facing a complex situations. I admit not having consciously made use of all those tools during the group work. Some reasons for that were maybe the presentation of those tools being very little rooted in examples from reality - making it hard to figure out how to actually utilize them - and my reluctance to theory in general."*

Here, the participant is expressing the view that the course content can be helpful. However, the participant goes on to say that the presentation of the course content (i.e., the facilitation) contributed to the participant not fully utilizing the course content. Thus, this is an example where participation by teachers is the right code to use. This is an example of the second category: the participant describes that others (in this case, the teachers)

Transformative learning is defined in D3.1 as follows:

Mezirow (2003) defines transformative learning as "[…] learning that transforms problematic frames of reference–sets of fixed assumptions and expectations (habits of mind, meaning perspectives, mindsets)–to make them more inclusive, discriminating, open, reflective, emotionally able to change".

And further:

Mezirow and Associates (1990) call transformative learning: "…learning experiences that leave a significant impact on the learner, a paradigm shift that shapes the learner and affects subsequent experiences".

Example 11: **transformative learning**

Participant: "I think that in August I was more focused on what knowledge I was going to learn, and I think, in addition to other factors (such as poor sleep), that to an extent made it difficult for me to absorb the other aims of this program. But now I appreciate more the value of experience-based learning and reflection. I feel I may some time look back at the two courses and recognise some ways in which it will have impacted my modes of thinking"

Here, the participant is relating back to how her mindset was at the beginning of the semester and see that it has changed through the course. The shift is here from being focused on content to starting to appreciate other forms of learning and being more interested in the processes. Transformative learning is a long process, and is not very likely to be visible within one semester, but elements of a shift in mindsets can be detected, as this example shows. This is an example of the second category where participants

Writing a coding log

While you are coding, you should keep track of what you are doing and why you are doing that. In fact, you should keep such detailed track of your coding process that anyone can take over at any point in time. For example, if you decide at one point to add a code to the coding tree, you should write that down in the coding log along with an explanation of why you took that decision. You should also write down in your log that you decided to take out a certain data source and why (because the participant has withdrawn consent, for example).

If you work with several coders together in your case, you should keep track of what each of you are doing and when, so the others should only check the coding log in order to know where to start from.

Writing a coding log is crucial to enable yourself to check for consistency in your coding, to enable a check for consistency across cases, to avoid doing double work, and to keep track of rigour in the data analysis process.

Examples from the **NMBU coding log**:

2020-01-28

Åsmund: coding

WP2_2.2_NMBU_2019_exercise 1_beginning of semester_student 389_2019-08-21

- While coding, I notice that "systems thinking" comes up many places. Should we add this as a code? Seeing the whole instead of only the parts is repeated as necessary for making the desired change.
- I also question the reliability of the data since the timing of these responses are questionable. The students received these questions in the introductory week to the MSc program where they were introduced to "our" way of interpreting these challenges. Their responses might be quite biased.

2019-01-16

Åsmund and Lutgart: Compared our coding for

WP2_2.2_NMBU_2019_exercise 1_beginning of semester_student 399_2019-08-21

Dissimilarities in coding and what we agreed upon:

"This requires also knowledges especially in problem- and conflict management."

- Lutgart had coded as Competence/dialogue and as Competence/facilitation/by students
- Åsmund hadn't coded because the student explicitly mentions knowledge only

We agreed that for this dataset, where students do not have much notion yet about competences versus knowledge etc., we can code it with the competences because a student might call this knowledge while s/he is not distinguishing between knowledge and competences yet.

INTERCODER CHECK: From multiple coding styles to a converged coding

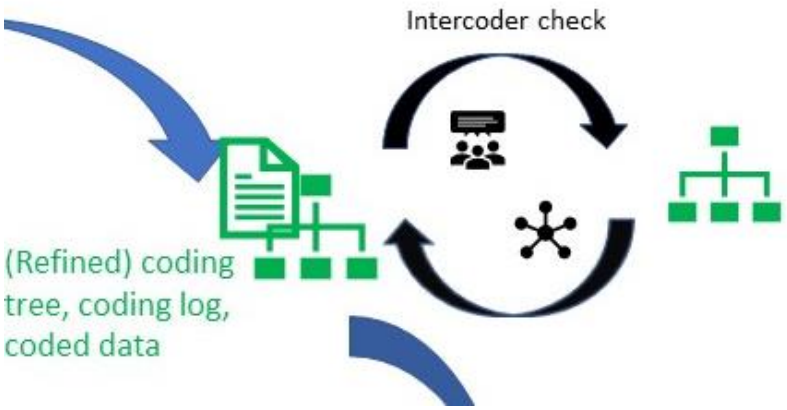

Figure 5: Visualization of the intercoder check phase of data analysis (excerpt from fig. 1)

WHO?	Everyone involved in coding, case leader
START WITH	Data coded individually by several coders, following the provided coding tree
END WITH	Data coded according to a refined and converged coding tree

Checking for **intercoder reliability** means making sure that coders see the same things when they code the same block of text (Bernard 2006). Qualitative data analysis software can help you to calculate how much two coders are in agreement through a statistic test called **Cohen's kappa**, or *k.* "When *k* is 1.0, there is perfect agreement between coders. When *k* is zero, agreement is what might be expected by chance. When *k* is negative, the observed level of agreement is less than what you'd expect by chance. And when *k* is positive, the observed level of agreement is greater than what you'd expect by chance." (Bernard 2006:513). In this context, it means the following:

K = 1	Perfect! No further refinement is possible!
K = [0.7, 1)	Great! No further refinement in necessary!
K = (0.2, 0.7)	Good! Try to resolve intercoder discrepancies.
K = (0, 0.2]	Oops! Refinement is necessary!!!
K is negative	Oops! You might need to start all over again!!!

You should do intercoder checks until you have reached a *k* of 0.70 or higher.

Examples of resolving intercoder discrepancies from coding log:

2019-01-16

Åsmund and Lutgart: Compared our coding for

WP2_2.2_NMBU_2019_exercise 1_beginning of semester_student 399_2019-08-21

Dissimilarities in coding and what we agreed upon:

"This requires also knowledges especially in problem- and conflict management."

- Lutgart had coded as Competence/dialogue and as Competence/facilitation/by students
- Åsmund hadn't coded because the student explicitly mentions knowledge only

We agreed that for this dataset, where students do not have much notion yet about competences versus knowledge etc., we can code it with the competences because a student might call this knowledge while s/he is not distinguishing between knowledge and competences yet.

"Thus, we have to link these knowledges with action, in order to make our food-print really relevant and efficient. That is why, we have to bridge the gap between knowing and doing."

- We both coded for Competences/participation
- Åsmund also coded for Competences because it hints at more competences than participation only

We agreed to follow Åsmund's method.

EXTRACTION: Getting a first view on the structuring of your data

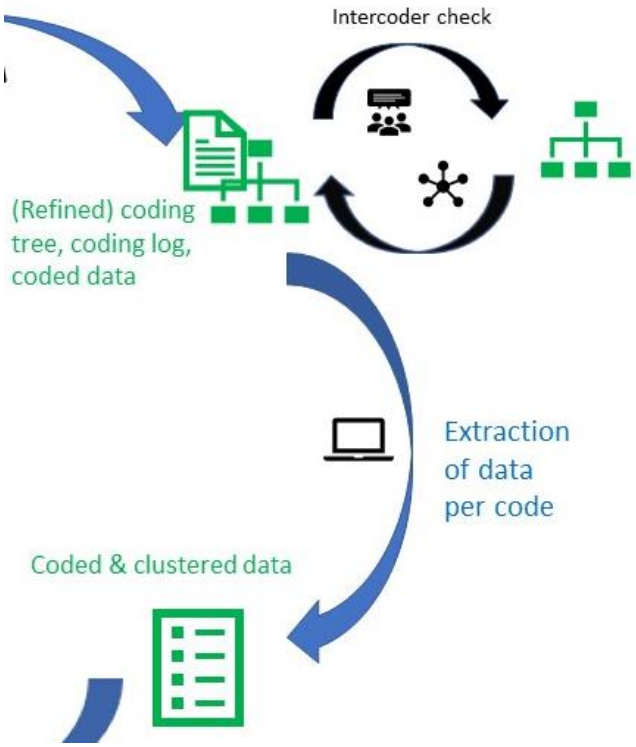

Figure 6: Visualization of the extraction phase of data analysis (excerpt from fig. 1)

WHO?	The one(s) who will write the case development report
START WITH	Data coded according to the (refined and converged) coding tree
END WITH etc.	Excerpts of text per code, visual representations (e.g. word cloud)

At this stage it is time to start looking at what the coded data indicates. We are now starting to converge towards writing the results of the course cycle that you analysed data from. There are many possible ways to extract insights from the coded material and depending on the amount of data you have, we recommend different approaches. In either case, the first step is to group all the coded data by codes and by data type. If you didn't make changes to the coding tree, you have 10 codes, which means that per data type (e.g. reflection documents, interviews, exercises), you should have 10 reports, one for each code. You can, of course, opt to ask for only one report for facilitation instead of three (facilitation, facilitation by students, facilitation by teachers).

If you have only a few pages of coded material per code per data source, you shouldn't do any further grouping. You should then extract all quotes? per competence. (In NVivo, this is done by double-clicking each code/node). You should then proceed to the next step, which is analysis and discussion.

If you have a large amount of data per code, it might be a good idea to use some visualisation tools to help guide your further analysis.

ANALYSIS & DISCUSSION: Asking yourself “what do the data tell us?”

Figure 7: Visualization of the analysis & discussion phase of data analysis (excerpt from fig. 1)

WHO?	1st) Researchers who know the Nextfood approach (case leaders); 2nd)Everyone involved in implementing the Nextfood approach in your case
START WITH	Excerpts of text per code, visual representations (e.g. word cloud),…
END WITH	Preliminary findings, new research (sub)questions, needs for clarifications

You’ve now reached the final step before writing the case development report. It starts by reading through the clustered material and looking for trends, commonalities and discrepancies related to the research questions mentioned in the introduction. It is paramount to spend time and energy on this step and it cannot be left to an algorithm. NVivo and other software has functions for clustering, structuring and visualising the coded data, but as Bernard (2006:519-520, italics in original) points out, “Computer programs do a lot, but in the end, *you* do the analysis; *you* make the connections and formulate hypotheses to test; *you* draw conclusions and point them out to your readers”.

The first step you should take when analysing your coded material is to investigate the outcomes from the different data materials per code. Examples of useful questions to guide your analysis are:

- What components of the course seems connected to transformative learning based on what the students write in their reflection documents?
- How do the students describe competence development throughout the course?
- Which parts of the course are related to the development of which competences?

- How do the responses to the questions compare from the beginning of the semester to the end regarding competence development?
- How can the qualitative data help explain the results from the self-assessment of competences?

The answers to these guiding questions will enable you to start writing section 3 of the case development report where you are asked to answer the broader question of "What do the data indicate? Present your analysis in a structured and clear manner.".

Throughout this process you will probably also realise ways you could have done either the data analysis or collection differently. This is why we recommend you to not stop after writing the case development report, but to go on to the next and final step in this instruction document.

LEARNING FURTHER: Going back to coding, or collecting new/additional data

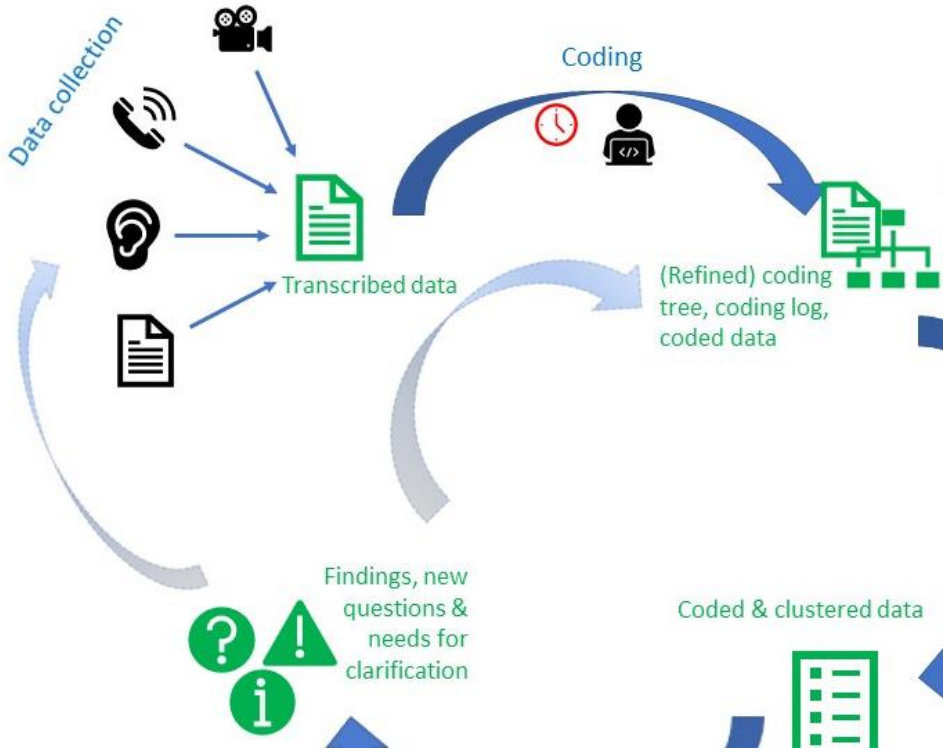

Figure 8: Visualization of the learning further phase of data analysis (excerpt from fig. 1)

WHO?	The researchers who conducted the data analysis and those who conducted the data collection
START WITH	Overview of the previous analysis and collection process
END WITH	Refined codes/analysis strategy for the data you had and/or new strategy for data collection for next cycle

At the end of a data collection and analysis cycle, it is important to evaluate the process. For some of you, this might have been one of your first attempts at analysing qualitative data and for all of us, this has been the first time following these instructions. So, how can we improve on the process for the next cycle?

We suggest that you take some time to review the process of data collection and data analysis. Ask yourselves the questions:

- How well did we follow the protocol with regards to data collection?
- How can we improve our data collection strategy to benefit our analysis of the case activities?
- How well did we follow the instructions with regards to data analysis?
- How can we improve our data analysis strategy to gain the maximum possible insights out of the data we collected?

Use the answers to these questions as basis for dialogues within your data collection/analysis team to determine the necessary changes you need to make. The sooner you do this after the analysis is done, the better you will remember the important details. And hopefully you have a coding log with many interesting remarks that can be used for this step too (and if not, maybe this can be a point of improvement for next cycle?).

Once you're done with this final step it is time to give yourselves a big round of applause and set your sights for the next round of data collection to begin.

References

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Instructions for data analysis – Numerical

Version 1.0

As mentioned in the Research Protocol (D2.1), rigorous data collection and analysis is paramount to the success of the action research in the Nextfood project. In order to ensure consistent data collection, the Research Protocol provides instructions on how to collect data from the activities carried out when following the Manual for Case Development (D2.2). Once the data have been collected, they need to be analysed in a consistent and rigorous manner in order to allow for fact-based improvement of each case and for cross-case comparisons. Our aim is therefore to provide you with clear instructions on how to analyse the data that you are collecting throughout the activities in your case.

With the instructions provided in this document we aim to support you in analysing the data that you have collected as **numerical data**. These are the the **data relating to or expressed as a number or numbers**. Please note that those data are only *expressed* as numbers, they are not numbers *per se*. Therefore, these numerical data cannot be analysed in a purely quantitative way, which some of you might be familiar with. We will explain the types of data and how to analyse them in detail in this document. For now, please bear in mind that "[a]nalysis is the search for patterns in data and for ideas that help explain why those patterns are there in the first place" (Bernard 2018:355).

In this document, we will first have a closer look at what kind of numerical data we have. Are they really numerical after all? Next, we look at how we can analyse the kind of data we have. Finally, we guide you through the analysis we suggest, in a step-by-step manner.

Contents

What kind of numerical data do we have?

In line with the Research Protocol, all cases should collect the following data:

- **Self-assessment of competences (**scale 1-9, representing "novice" up to "expert"**)**
- **Ranking of shifts (flipchart/whiteboard at workshops,** scale 1-10, representing "entirely according to conventional linear education system" up to "entirely according to a transformative and participatory learning model (NF approach)"**)**
- **Course evaluations** (scale 1-7, meaning "worst, inefficient" up to "excellent")
- **Demographics**
  A. Number of students starting the educational activity (male and female)
  B. Number of students passing the educational activity
  ~~C. Educational background of students (high school, bachelor, master, PhD)~~
  D. Number of students with more than three years of experience in the field/business,
- **(Forthcoming: results of questionnaire for stakeholders,** scale 1-5, representing "I fully disagree" up to "I fully agree"**)**

Apart from the demographics, all these data are **scalings**. "*A scale is a device for assigning units of analysis to categories of [a] variable.* The assignment is usually done with numbers, and questions are used a lot as scaling devices." Bernard 2018:254, italic in original). It is important to bear in mind that the respondent is the principal source of measurement error in this kind of data collection (Bernard 2018).

For example, in the self-assessment of competences, we can *scale* students per competence according to how they assess themselves for that competence. Thus, students are our "units of analysis"; the five core competences (observation, participation, dialogue, visioning and reflection) are the five variables we want to look into; and each of those variables has nine categories ("novice" up to "expert").

Furthermore, these are all **single-indicator scales** (Bernard 2018:255), whereby we assign units of analysis to categories of a variable.

For example, in the self-assessment of competences, given that students can choose only one level of competence for each of the five competences, we assign each student per competence to one category of the variable.

Moreover, these data are scalings with scaling devices that produce numbers that have **ordinal properties**. This means that numbers represent words that represent position or rank in a sequential order (Wikipedia: Ordinal numeral).

For example, in the self-assessment of competences, someone who has assigned him/herself to “1=novice” for reflection and to “9=expert” for dialogue, is *less* competent in reflection than in dialogue (according to him/herself). However, we don’t know if that person considers him/herself exactly 9 times less competent in reflection than in dialogue because we are working with an ordinal scale.

To sum up:

Our numerical data are scalings, collected using single-indicator scales with scaling devices that have ordinal properties.

How do we analyse those data?

Before we explain the details of how to analyse, let’s have a look at the **research questions** again. The research question we would like to answer is:

How and to what extent do various educational activities enhance the students’ abilities to deal with ‘the challenge of the whole’, including to take or facilitate informed action, and the competences considered necessary for doing so (observation, reflection, dialogue, participation and visioning)? (D2.1 Research protocol:11).

For example, based on the self-assessments of competences, we can gain insight into the extent to which a full course enhances students’ competences (as assessed by the students themselves), for each of the competences, and averaged out over the entire student group. Please note that we are not interested in comparing between students. Rather, we would like to know if the course has a positive or negative effect on students’ competence enhancement on average.

This means that we will do a **bivariate analysis** of the data we have. Most importantly, we would like to measure the difference between two averages. This can be done with a ***t*-test** that evaluates whether the averages of two different groups differ on some variables.

For example, when analysing the self-assessments of competences, we will conduct a *t*-test to evaluate per competence whether the average for all students at the start of the course differs from the average for all students at the end of the course. This means that we will do five *t*-tests, one for each competence, whereby we compare the average for that particular competence at the start of the course with the average for that particular competence at the end of the course.

Doing a *t*-test: Comparing two means

First of all, we do a quantified structuring of the data. Then, we will analyse that structuring qualitatively. This means, that we will look at the numbers generated by the *t*-test and think through what they mean.

Bernard (2018:355, box 15.1): Data processing and data analysis:

Most methods for quantitative analysis – things like factor analysis, cluster analysis, regression analysis, and so on – are really methods for data *processing* and for finding patterns in data. Interpreting those patterns- analysing them, in other words-is up to you. Interpretation-telling us what findings mean, linking your findings to the findings of other research-starts with ideas in your head and comes out in words on paper. It's a pretty qualitative exercise.

Quantified structuring of the data

In Microsoft Excel, you can calculate the mean for the whole student group, for each competence, at the beginning of the course, and at the end of the course.

Then, excel can run the ***t*-test** for you.

Next, you can evaluate the **statistical significance** of *t* at different levels of statistical significance.

Statistical significance is expressed as a percentage, and gets the symbol (letter) P. Conventionally, $P < 0.05$ is referred to as 'statistically significant'. This means that your result is significant at a level below 5%, meaning that there is less than 1 in 20 chance that the result is wrong. Likewise, $P < 0.01$ is referred to as 'statistically very significant' (less than 1 in 100 chance), and $P < 0.001$ is referred to as 'statistically highly significant' (less than 1 in 1000 chance of being wrong).

If $P \geq 0.05$, your result is not statistically significant.

Qualitative analysis of the structured data

Now, it is time to look at the results of your *t*-tests and interpret them.

First, you should look for each competence if the difference between the two means is significant at level $P < 0.05$ or even better.

If the difference is **not statistically significant** for a certain competence, you can look into the dataset lying behind to see if there are major 'outliers' that might cause the insignificance. An **outlier** is a special case, for example one individual student whose self-assessment for that competence differs a lot from those of the other students. In that case, you can do a *t*-test for the **medians** for that competence. "The median is the point in a distribution above and below which there are an equal number of scores in a distribution" (Bernard 2006:563) and is less affected by extreme scores than the mean. If there are no outliers, that means your course has not caused a significant change in development of that particular competence in your students on average.

This is an important finding! You can now think why that particular competence is not significantly developed in your course and what you would do different in the next cycle of your course to significantly improve the development of that competence. Or, maybe your students had (on average) assessed themselves already at the beginning of the course as experts in that competence and thus, there was very little need or room for further development. Other datasets can set light on your throughs as well.

If the difference is statistically **significant** for a certain competence, that's an important finding as well. Hopefully, the difference is a significant increase in development of a competence, and not a decrease. You can then look at other data sets and develop your own ideas about why your course has caused a significant increase in students' competence development for that particular competence.