Deliverable D3.1: Requirements engineering

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Executive Summary

This deliverable provides an overview of the functional and non-functional requirements of the overall learning-enhanced system, developed in the WATCHME-project. This deliverable has gradually grown and received input from different work packages, such as WP2, WP4, WP5 and WP6. It is the results of a joint activity of the technical partners.

In the first chapters a description is given of the specific goal of WP3 and the different stakeholders to be considered when formulating requirement. In addition; a description is provided of the EPASS system given that this the portfolio system that is used within the WATCHME-project; as well as the different assessment systems in order for the reader to get a clear understanding of the architecture. Given that after the WACTHME-project the developments should also be applicable to other portfolio systems; the requirements are formulated in generic terms in order to allow for this transfer.

Following these more stage-setting chapters the users’ needs in terms of JIT-feedback and visualizations are described. In order to gain insight into these users’ needs; different stakeholders meetings were organized and surveys were administered. This resulted in a list of requirements for each track that will be further fine-tuned after prototyping. In addition, expert interviews were done to gain more insight into the pedagogical model needed within the student model. The final chapters provide insight into the requirements with respect to the privacy issues; security as well as maintenance.

While this deliverable does provide insight into the requirements; it should be noted that this is the current state as for M22 of the project. Further discussions will need to take place between educational partners and technical partners; and input from the formative assessment may result in an adaptation of the requirements.

However, it can be stated that the main priorities are that for the users the additional information they receive within their portfolio, through the JIT and VIZ-module:

- reflects the student’s learning process,
- is easily accessible and understandable,
- is up to date,
- adds to the information they can receive in each individual assessment form, and
- helps supervisors to make decisions with respect to entrustability.
1. Introduction

This deliverable provides an overview of the functional and non-functional requirements of the overall learning-enhanced system, developed by the WATCHME project. This document has gradually grown and received input from different other Work Packages, such as WP2, WP4, WP5 and WP6. All technical partners contributed to the specifications of the requirements of the learning analytics enhanced portfolio system.

In the first chapters a description is given of the specific goal of Work Package 3 and the different stakeholders to be considered when formulating requirements. In addition, a description is provided of the EPASS system, as this is the portfolio system that is used in the WATCHME project, and the different assessment systems in order for the reader to fully understand the architecture. The requirements are formulated in generic terms in order to allow transfer to other e-portfolio systems.

This deliverable contributes to the main goal of the WATCHME-project, namely “To prove that learning analytics in an electronic portfolio-environment can help to increase the quality and efficiency of workplace-based feedback, assessment and the development of professional expertise” by providing clear requirements for electronic portfolio to succeed in creating this powerful learning environment.

It should be noticed however, that although this is a deliverable containing requirements, the results of the formative and summative evaluation may alter to some extent the requirements; hence this document is a list of requirements at this time (M22) in the project.

The deliverable is written in such way that is should be readable for technical and non-technical people. To get a quick overview of all user requirements that came out of the requirements study we point you to Annex 1, which provides a list with requirements, an identification number; a short description and whether or not it will be included in the WATCHME-project.

2. Description of goals, organizations, stakeholders, and end users involved

2.1 Goals

This deliverable aims at providing a clear view of the requirements of the learning-analytics enhanced portfolio system in order to become a better learning instrument. In order to get a good view on these requirements it is necessary to get a clear description of the stakeholders and end-users.

These requirements should allow creating a context specific student model able to generate tailored feedback. To create this student model the e-portfolio needs to be extended with a Just-in-Time Module (JIT) and a Visualization Module (VIZ).
2.2 Organizations, stakeholders and end-users

To define the requirements of the learning-enhanced portfolio system it is important to describe the stakeholders and the end-users:

- **Institutions** (e.g., schools, universities, hospitals) making use of digital portfolios for workplace-based feedback, assessment and professional development in their curricula. By applying the learning-enhanced portfolio to three disciplines (medicine, veterinary and teacher education) different contexts are considered in developing the learning-enhanced portfolio and hence will allow to transfer the portfolio and its student module to other disciplines after the project. In addition this portfolio should also allow for customization to characteristics of specific institutions and their educational programs.

- **Developers of digital portfolio**: while EPASS is the starting point for the portfolio within the WATCHME project, all requirements will be formulated in generic terms to allow for transfer to other portfolio systems.

- **Educational Scientists**: in order to make a system that can increase the quality and efficiency of workplace feedback it is necessary to be able to collect the necessary data to evaluate and adjust the system. This will allow gaining more insight into a learner’s behavior and will provide possibilities to make the student model even more adaptive.

- **Teachers / supervisor**: the learning analytics enhanced portfolio should provide teachers and supervisors (e.g. medical specialist, residents) with just-in-time information on students’ progress, provide information on how far students are in developing the necessary competencies. This will allow for them to provide targeted feedback.

- **Students**: the learning analytic portfolio should result in deeper learning for the student by providing tailored feedback and providing students a mirror to see where they stand with respect to achieving the necessary competencies.

These different stakeholders and end-users will influence how the portfolio will look like and what functionalities are needed to comply with the different stakeholders’ and end-users’ needs.

3. Description of main processes around workplace-based assessment and feedback

As indicated in the project proposal (DoW), workplace-based learning and hence feedback and assessment becomes more and more important given that also professionals should invest in lifelong learning and secure continuous accountability. In order to develop professional expertise feedback on and assessment of activities in the workplace is critical and a very powerful source in professional learning (Ericsson, Charness, Feltovich; & Hoffman, 2006; Hattie, 2009). Typically this process of feedback and assessment is based on a portfolio-system.
Workplace-based e-Assessment Technology for Competency-based Higher Multi-professional Education

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This allows for learners to collect feedback, assessments and evidence, all conveniently arranged, in order to monitor their progress, based on an appropriate underlying competency model. By integrating different assessment instruments (see further) communicating with an underlying student model allows for adaptive feedback.

To describe the processes around workplace-feedback it is started with the description of the E-Pass system and a description of the different assessment instruments.

3.1 An e-portfolio: EPASS

EPASS is the acronym for a web-based ‘Electronic Portfolio and Assessment Support System’, and is developed to support the learning and assessment of health professionals. EPASS facilitates competency-based learning. EPASS is designed for participants in all health professional education, e.g. undergraduates, residents in postgraduate training and specialists in a medical context. At the moment EPASS is only used in medical contexts, e.g. by trainees in (veterinary) medicine, nurse practitioners and medical specialists. However, by the setup EPASS can easily be tailored to specific demands and needs in non-medical contexts, as proposed for the educational domains of WATCHME.

Competence-based learning forms the theoretical base of EPASS. For example, the CanMEDS Physician Competence Framework¹ is often used in medical education and consists of seven competences: ‘Medical expert’, ‘Professional’, ‘Manager’, ‘Health advocate’, ‘Scholar’, ‘Collaborator’ and ‘Communicator’. Although a competence model is contextual and indivisible in its interpretation, the collection of information on performance and functioning by means of different assessment instruments linked to competences helps to monitor the learners’ progress.

The learner can add relevant information concerning his/her performance and development progress to this portfolio through the different assessment instruments, as well as the teacher or supervisor.

3.2 Description of the assessment instruments in EPASS used in the WATCHME-project

EPASS provides different assessments tools and rounds:

- Workplace-based assessment forms
- Multisource feedback rounds
- Peer feedback forms
- Forms for registration of (medical) procedures and corresponding declarations of competence
- Registration on summative entrustment decisions on EPAs
- Other evidence

¹ http://www.royalcollege.ca/portal/page/portal/rc/canmeds/framework
3.2.1 Workplace-based assessment forms

In a workplace-based assessment form, a supervisor observes and rates the performance on a variety of competencies and provides instant feedback. Within EPASS the rating by the supervisor is mostly done on a five point Likert-type scale from disagree to agree, also called a Visual Analogue Scale (VAS). These assessment forms can contain different VAS. For example the overall performance may be rated on a three-point scale from below to above expected level; and the required level of supervision could be rated on a five-point scale from no to strict supervision. All individual forms based on low stake judgments are used for formative purposes.

The assessment form contains three types of results. **Alphanumeric results** (see Figure 1) display the scores for each question on the different competence domains. The competence domains and rating scales (VAS) may differ.

![Figure 1: Example of alphanumeric results in a validated assessment form](image)

**Narrative results** (see Figure 2) describe the strengths, points of interest/areas in need of improvement, agreed future plans and possible comments about the assessment in a verbal way. Narrative results will be shown mainly in the JIT with selected messages appearing in the VIZ-module (a further description is given in chapter 4).
Visual results aggregate data into averages and are presented in the VIZ module, for example, in line charts, column diagrams and spider graphs. Visualizations will show individual student’s progress and performance as well as comparisons to predefined standards and groups. These overviews are automatically aggregated based on the alphanumeric results on the different competence domains in the inserted assessment forms in the portfolio. The available overviews are explained and graphically displayed in section 2.3.

3.2.2 Multisource Feedback or 360-degrees feedback

The performance of the learner can be evaluated in a Multisource Feedback (MSF) Round or so-called 360⁰-feedback round by people who work alongside the learner and are able to observe the learner at work over a prolonged period of time (Atwater, Brett, & Charles, 2007). It is recommended to ask people with different perspectives for workplace-based feedback. The MSF in EPASS uses judgments of many people, for example supervisors, peers and co-workers, other colleagues (nurses, social workers, administrative assistants, psychologists, etc.). Research shows that MSF can be a reliable instrument when two MSF occasions are completed by at least 10 assessors, or three MSF occasions by five assessors (Moonen - van Loon, Overeem, Govaerts, Verhoeven, van der Vleuten, & Driessen, 2015; see also D3.3). The learner him- or herself fills out a self-assessment. The goal of a MSF is to give the learner an (overall) idea of his/her functioning, strengths and points of improvements.

A MSF round can be approved or disapproved by the learner or by the supervisors, based on the number and roles of the respondents. An aggregated feedback report of the MSF round is generated after approval. In this report the anonymous answers and scores of the
respondents are displayed; individual answers are not included. Figure 3 is an example of a (part of) multisource feedback report. In this example the different assessors (respondents) are named with their roles. This is an option, one can also choose to only show the roles of the assessors without the names, so anonymously.

<table>
<thead>
<tr>
<th>Multi source feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resident:</strong> Patricia Smith</td>
</tr>
<tr>
<td><strong>Hospital:</strong> MUC+</td>
</tr>
<tr>
<td><strong>Specialty:</strong> Family</td>
</tr>
<tr>
<td><strong>Assessed on:</strong> 05-12-2013</td>
</tr>
<tr>
<td><strong>Status:</strong> Confirmed at 05-12-2013 by Smith</td>
</tr>
<tr>
<td><strong>Respondents (Alphabetical):</strong></td>
</tr>
<tr>
<td>Cynthia C. Wehbo (Resident/Fellow)</td>
</tr>
<tr>
<td>Dr. Brian W. Blake (Assessor)</td>
</tr>
<tr>
<td>Dr. Jessica K. Guber (Assessor)</td>
</tr>
<tr>
<td>Heather M. Field (Other colleague in health care)</td>
</tr>
<tr>
<td>Keith A. Morton (Other colleague in health care)</td>
</tr>
<tr>
<td>Krystal T. Givens (Resident/Fellow)</td>
</tr>
<tr>
<td>Leonard M. Riden (Resident/Fellow)</td>
</tr>
<tr>
<td>Mary B. Barr (Other colleague in health care)</td>
</tr>
<tr>
<td>Terrie M. Stephens (Other colleague in health care)</td>
</tr>
</tbody>
</table>

**General / additional comments concerning the resident’s functioning:**

- Respondent (Resident/Fellow):
  - Very friendly
- Respondent (Resident/Fellow):
  - Stress resistant
  - Empathetic
  - Medical technical skills
- Respondent (Assessor):
  - Friendly, nice to work with
- Respondent (Assessor):
  - Friendly,
  - Clear explanations
- Respondent (Other colleague in health care):
  - Nice to work with
  - Friendly towards colleagues and patients
- Self:
  - Obstetrics
  - Empathetic

**Medical experts:**

1. Independently handles routine patient problems accurately and at an adequate pace.
   - Score: 4.2 (3-5, n=9), Self: 4
2. Independently handles complex patient problems accurately and at an adequate pace.
   - Score: 3.8 (3-5, n=9), Self: 3
3. Masters medical technical skills/procedures and applies these adequately.
   - Score: 3.9 (3-4, n=9), Self: 3
4. Pays sufficient attention to the psychosocial aspects of disease.
   - Score: 4.1 (4-5, n=9), Self: 4
5. Acts in accordance with the current state of affairs in the field.
   - Score: 4.0 (3-5, n=9), Self: 3

![Figure 3: Anonymous answers of respondents in the multisource feedback round](image-url)
3.2.3 Peer feedback forms

The starting point for workplace-based assessments is that persons in a supervisory role assess learners. However, within education more and more attention is given to peer feedback, meaning that learners assess each other. Research has shown that peer assessment can improve the effectiveness and quality of learning (Topping, 2009). All workplace-based assessment forms as described in section 3.2.1 can also be made available to be filled out by a peer student/resident.

2.2.4 Forms for procedures and declaration of competence

EPASS offers the possibility to request and register procedures and associated levels of entrusted ability.

Procedures can be registered by the learner, in which he/she indicates which procedure was performed on which date and in which type of context of the procedure. When the learner thinks he is capable of performing a procedure on a certain (Miller) level\(^2\), a declaration of competence can be requested. A supervisor will assess the request based on the information in the portfolio and the argumentation of the learner.

An (yearly) overview of registered procedures and declaration of competences can be viewed in the portfolio (see Figures 4 and 5).

\(^2\) Miller's pyramid is a framework used for assessing levels of clinical competence. Four levels are distinguished: ‘Knows’ (knows some knowledge), ‘Knows how’ (knows how to apply that knowledge), ‘Shows’ (shows how to apply that knowledge) and ‘Does’ (actually applies that knowledge in practice). (Ramani & Leinster, 2008).
3.2.5 Registration on summative entrustment decisions on EPAs

EPASS offers the possibility to request and register levels of entrusted abilities on EPAs. If a learner thinks he's capable of performing an EPA on a specific entrustability level, a declaration for an entrustment decision can be requested. A supervisor will assess this request based on the gathered evidence and information in the portfolio for the respective EPA.

An overview of registered declaration of competences can be viewed in the portfolio (see Figure 6). There is a possibility to zoom in on a specific EPA in order to view the collected information and evidence.
3.2.6 Other evidence

Besides workplace-based assessment forms, learners can also collect other types of evidence in their portfolio, e.g. registration of given presentations, publications, teaching activities and attended conferences, lesson preparation, etc. A supervisor could for example use the collected evidence in his decision making to approve a summative decision.

3.2.7 Context

Each assessment instrument is linked to a specific ‘context’. This context is defined by different elements:

- a theme: curricula are often organized according to themes rather than specific subject domains, forcing learning to look from different perspectives to a phenomenon
- a curriculum phase
- an education plan (containing requirement, goals, assessment instruments)
- supervisor
- discipline: disciplines within the WATCHME project include medicine, veterinary or teacher education
- (part of) an entrusted professional activity
- Context of assessment: this is defined by the assessor (self, peer, teacher, supervisor) and by the case (complexity and information).

These metadata are needed to communicate with the student model and hence to provide adaptive feedback to the learner (see D4.2).

3.2.8 Selected instruments

Different assessment instruments are currently integrated in EPASS (see also D3.5). We provide here a short overview of the selected instruments:

- For Anesthesiology Utrecht:
  - Adjusted version of Mini-Clinical Evaluation Exercise (Mini-CEX)
  - Objective Structured Assessment of Technical Skills (OSATS)
  - Adjusted version of Multisource feedback (MSF)
  - Summative entrustment decisions on EPAs

The Mini-CEX and OSATS forms are examples of workplace-based assessment forms.

- For Undergraduate Medical Education Utrecht:
  - Short Practice Observation EPA 1a: Vital parameters
  - Short Practice Observation EPA 1b: History taking and general physical examination
  - Short Practice Observation EPA 2a: Basic medical procedures
  - Case-Based Discussion EPA 1a: Vital parameters
  - Case-Based Discussion EPA 1b: History taking and general physical examination
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- Case-Based Discussion EPA 2a: Basic medical procedures
- Forms to register summative entrustment decisions on all three EPAs
All Short Practice Observations and Case-Based Discussions are workplace-based assessment forms.

- For Undergraduate Medical Education Berlin:
  - Short Practice Observation EPA 1: History taking, physical examination and reporting
  - Short Practice Observation EPA 8: Medical procedures
  - Case-Based Discussion EPA 1: History taking, physical examination and reporting
  - Case-Based Discussion EPA 8: Medical procedures
  - Interview report EPA 2a: Develop a diagnostic plan and initiate implementation
  - Interview report EPA 3: Interpret diagnostic results and initiate next steps
  - Interview report EPA 4: Develop a treatment plan and initiate implementation
  - Registration of medical procedures
  - Summative entrustment decisions on EPAs
All Short Practice Observations, Case-Based Discussions and Interview Reports are workplace-based assessment forms.

- For Teacher Training Utrecht:
  - Feedback form on tasks and assignments (formative evaluation 11 tasks)
  - ICALT (International Comparative Analysis of Learning and Teaching)
  - QTI (Questionnaire on Teacher Interaction) multi source feedback round
  - Four mid-term internship assessment forms (including self-assessment form):
    - Internship 1 school mentor
    - Internship 2 school mentor
    - Internship 1 university teacher
    - Internship 2 university teacher
  - Four final internship assessment forms (including self-assessment form):
    - Internship 1 school mentor
    - Internship 2 school mentor
    - Internship 1 university teacher
    - Internship 2 university teacher
  - Summative evaluation of the 11 tasks
The feedback form on tasks and assignments, ICALT and eight internship forms are examples of workplace-based assessment forms. The QTI is an example of a multisource feedback round.

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3 The ‘Interview Reports’ were added after a first user test in September 2015, and hence this differs from what is reported in D3.5
● For Teacher Training Tartu:
  o Feedback form on tasks and assignments (‘Tagasiside protokoll’)
  o Summative evaluation of the 12 tasks
The feedback form is an example of a workplace-based assessment form.

● For Veterinary Medicine Utrecht:
  o Mini-Clinical Evaluation Exercise (Mini-CEX)
  o Mini-Clinical Evaluation Exercise (Mini-CEX) peer-to-peer
  o Multisource feedback / 360 degrees feedback
  o Summative entrustment decisions on EPAs
Both Mini-CEX forms are examples of workplace-based assessment forms.

● For Veterinary Medicine Budapest:
  o Mini-Clinical Evaluation Exercise (Mini-CEX)
  o Mini-Clinical Evaluation Exercise (Mini-CEX) peer-to-peer
  o Multisource feedback / 360 degrees feedback
  o Presentation blog
  o Summative entrustment decisions on EPAs
Both Mini-CEX forms are examples of workplace-based assessment forms. The presentation blog is an example of ‘other evidence’ (see section 3.2.6).

3.3 Integrated overviews

A summative decision upon the progress of the learner is taken by the formal supervisor who was granted access to the learners’ portfolio by the learner himself (more regarding privacy policy, see chapter 12). This high stake judgment is based on the complete portfolio of the learner. Several automatically generated overviews in the portfolio enable the authorized supervisor in making this high stake decision.

EPASS offers several types of overviews, for example lists of the forms and evidence stored in the portfolio. Aggregated (longitudinal) overviews of competency development based on the inserted assessment instruments are also displayed. These overviews are generated on the alphanumeric results and can be filtered per competency and/or learning period (e.g. semester). The results are presented in line diagrams (see Figure 7), bar charts (see Figure 8) and spider web diagrams (see Figure 9).
Figure 7: Example of longitudinal overview in learning progress regarding competence ‘Medical expert’ as a line chart

Figure 8: Example of longitudinal overview in learning progress regarding all competences as a bar chart
A narrative feedback overview is also available. All narrative feedback given by different assessors with different roles (e.g. residency program director, supervisor, mentor etc.) has been summarized in an overview as shown in Figure 10. The feedback can be filtered per competency and type of feedback (e.g. strengths, points of improvements).

**Figure 9: Example of longitudinal overview in learning progress regarding all competences as a spider web diagram**

**Figure 10: Example of narrative feedback overview**
Another type of available overviews concerns several summative numerical overviews (see Figure 5 and 11 for an example). In the EPA overview, the (dis)approved summative decisions per EPA on a specific supervision level are displayed. In the overview in Figure 11, all inserted forms and activities are numerically summarized per predefined periods (for example semesters).

<table>
<thead>
<tr>
<th>Overview forms per year-semester [Numbers]</th>
<th>resident not in training</th>
<th>1-1</th>
<th>1-2</th>
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<tr>
<td>Contracts</td>
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<tr>
<td>Critical Incident</td>
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<td>Mini-CEX-S</td>
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<td>OSATS</td>
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<td>PDP</td>
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<td>Strength-weakness</td>
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<table>
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<th>Medical procedure overview per year-semester [Numbers]</th>
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<th>1-2</th>
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<td>repair of 2nd degree obstetrical laceration</td>
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<td>curettage for abortion &lt; 10 weeks</td>
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<td>7</td>
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<tr>
<td>curettage for abortion &gt; 10 weeks</td>
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</tr>
<tr>
<td>management of post partum haemorrhage</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>forceps delivery</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>gynecological ultrasound</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>abdominal hysterectomy</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>vaginal hysterectomy</td>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>

Figure 11: Example of numerical overview in EPASS

Themes – the name for relevant overarching knowledge and skills-aspect regarding a specific part of a specialism – include certain abilities and description of features needed in order to say that one masters the knowledge and skills needed for that specific part of the training.
Whenever the curriculum is organized using themes, an overview of the progress within the themes is presented. These overviews are based on all forms, procedures and corresponding declarations of competences and other activities linked to the specific themes (see Figure 12).

![Figure 12: Example of theme overview within the residency training Pediatrics and Gynecology](image)

All overviews aim to give both learner and supervisor an overall idea of the progress in learning in general and on specific competencies.

### 3.4 Online support

Videos are available at the website of EPASS to show learners, supervisors, assessors and educators how to use EPASS for workplace-based assessments in different situations. The main goal is to give them insight into the added value of the good use of an e-portfolio. The videos are available via the following URL: [http://epass.eu/en/faq/instruction-videos/](http://epass.eu/en/faq/instruction-videos/). For teacher education, additional videos are made.
4. Users’ needs priorities in terms of ICT-enabled features regarding JIT-feedback and Visualization

In order to gain insight into the users’ needs in terms of ICT-enabled features regarding the JIT-feedback and the Visualisation module, a participatory design strategy (Berns, 2004; Könings, Brand-Gruwel & van Merriënboer, 2010)4 was used. Table 1 provides an overview of the different meetings and of the two surveys that were administered. Despite these meetings and surveys, little input on was provided with respect to the student model underlying the JIT-feedback and the Visualization module. For this reason a number of interviews with educational experts in the domain of feedback were conducted as well.

In this chapter the main findings of these workshops, meetings and surveys are presented, more detailed information can be found in the minutes of the different activities (see references in Table 1).

Table 1: Overview of different activities to gain insight into users’ needs

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Number of participants</th>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>19/05/2014</td>
<td>UMC Utrecht, Faculty of Medicine</td>
<td>22 (technical partners; undergraduate medicine; veterinary education, anesthesiology, teacher education)</td>
<td><a href="https://www.project-watchme.eu/dokuwiki/doku.php?id=wp345:start#st_meeting_with_stakeholders_19_may_2014_umc_utrecht_faculty_of_medicine">https://www.project-watchme.eu/dokuwiki/doku.php?id=wp345:start#st_meeting_with_stakeholders_19_may_2014_umc_utrecht_faculty_of_medicine</a></td>
</tr>
<tr>
<td>27/06/2014</td>
<td>UMC Utrecht; Anesthesiology department</td>
<td>9 (technical partner, Veterinary education, Teacher education, Anesthesiology)</td>
<td><a href="https://www.project-watchme.eu/dokuwiki/doku.php?id=wp345:start#nd_meeting_with_stakeholders_27th_of_june_2014_umc_utrecht_anesthesiology">https://www.project-watchme.eu/dokuwiki/doku.php?id=wp345:start#nd_meeting_with_stakeholders_27th_of_june_2014_umc_utrecht_anesthesiology</a></td>
</tr>
</tbody>
</table>

4 For a detailed overview of the method and the design used during the meetings is given in Scheurs et al., 2015)
Workplace-based e-Assessment Technology for Competency-based Higher Multi-professional Education

Deliverable 3.1: Requirements document

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Number of participants</th>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>22/07/2015 (10 a.m. – 4 p.m.)</td>
<td>UMC Utrecht, Faculty of Veterinary Medicine</td>
<td>~20 (veterinary education, undergraduate medicine, anesthesiology – trainers and trainees)</td>
<td><a href="https://www.project-watchme.eu/dokuwiki/doku.php?id=wp5:start">https://www.project-watchme.eu/dokuwiki/doku.php?id=wp5:start</a></td>
</tr>
</tbody>
</table>

4.1 First meeting with stakeholders (May 19th 2014)

The first participatory meeting aimed at generating a shared vision among the stakeholders, the benefits for the stakeholders, and clarifying what the project can mean for them (workplace-based assessment, EP, learning and assessment, and the vision on student-model, just-in-time feedback and visualization).

4.1.1 Stakeholder overview

The meeting resulted in defining four different groups of stakeholders:

- **Technical stakeholders**: software developer, sales department, configuration, maintenance and integration department
- **Managerial stakeholders**: government, chair of training program, educational management, hospital
**Deliverable 3.1: Requirements document**

- **Trainers / assessors:** workplace teachers, course teacher, fellow, senior resident, doctor, nurse and supervisor
- **Trainees:** resident, student in teacher education, student in veterinary sciences and student in medicine

Although these different stakeholders are defined; the focus is mainly on the trainers and the trainees.

**4.1.2 Meaning of WATCHME project for the stakeholders**

When thinking about what the project could mean once it is finished; the different participants focused on an environment that offers learners and teachers quality feedback anytime and anymore. They will have a system that monitors students’ progress, provides just-in-time personalized feedback. The system gives also decision support and provides instant information of the authorization for EPAs at the supervisor level. It will provide learners and students an easy overview of the learning process; and specifically for teachers they will get an overview of the learning of all students.

**4.2 Second meeting with stakeholders (June 27th 2014)**

The second participatory meeting covered workplace-based learning processes in three domains. This focus group session resulted in specifications of the requirements for the development of a learning enhanced portfolio system.

Firstly, different needs were defined for supervisors and teachers. For supervisors and teachers it is necessary to analyze a group of students from the same cohort and see the development of a particular student over time compared to the whole group. However; for supervisors this information does not need to be accessible on a smartphone, a regular personal computer is sufficient. Contrarily teachers wanted quick overviews accessible on a smartphone, as well as a more profound overview when they can access students’ portfolios (accessible on a normal PC).

Secondly, when discussing the topic of just-in-time feedback, it became clear that according to the participants the system should provide a notification either for the student to ask for feedback or for the assessor to induce an act of assessment. Different categories of just-in-time information were defined: 1) reminders/notifications; 2) content feedback, and 3) longitudinal feedback.

Thirdly, it is necessary to provide feedback in a quantitative (scores) and qualitative (narrative feedback) way to provide clear cut feedback on, for instance, knowledge tests, as well as more holistic feedback on competence level.

A fourth important aspect was the need of the participants to get insight into the progress of learning. This also meant receiving information over a longer period about students’ performance on a general level and to see the performance of a learner in the short term for particular activities.
Deliverable 3.1: Requirements document
4.2.1 Users’ needs based on second meeting insights

The insights from the second meeting resulted in the following user needs:

- Supervisors need to analyze a group of students from the same cohort.
- Supervisors need to see the development of a particular student over time, compared to the group.
- Supervisors need to access their views on their personal computer.
- Teachers need quick overviews on their smartphones.
- Teachers need more detailed overviews on their personal computer.
- Students need to be reminded to ask for feedback.
- Assessors need to be reminded to complete assessment forms.
- Users imagine JIT Feedback to cover three categories: reminders/notifications, content feedback and longitudinal feedback.
- Users expect feedback in quantitative (scores) and qualitative (narrative) form.
- Users want a holistic view of performance and competence level.
- Users want to see development over time.
- Users want to see performance on particular activities.

4.3 Meeting with anesthesiology (September 8th 2014)

The third participatory meeting concentrated on objectives for just-in-time feedback and visualization from a single domain, anesthesiology whose members had experience with using an EP system. Seven stakeholders participated.

The results revealed that participants valued narrative feedback over scores. The participants suggested making it possible to tag narrative feedback so that the system can track whether specific tags increase or decrease in number. With respect to the more numeric feedback, a comparison with peers or scores on European exams would be helpful to give the learner an idea of how they are progressing. The participants thought it would also be helpful for the learners’ attention to be drawn to differences between an assessor’s evaluation and self-assessment. Additionally, they indicated that trainees should be sent an alert when they miss certain milestones or appointments.

A number of rules were formulated for the system to know when a learner is not performing well:

- Number of mini-clinical evaluation exercises (mini-CEX) is dropping.
- Poor reflective skills: poor narratives, small sentences.
- Pattern in recent assessments.
• Poor performers seek supervisors who do not give feedback or only positive feedback (feedback avoidance).

With respect to the visualization module, a distinction was made between what a learner needs to see and what an assessor needs to see. For a learner it is important to see their own progress and whether they are reaching the different competencies. For an assessor it is important to see the current level of the trainee compared to the expected level. The history of the feedback should be visualized as well as a numeric score for the students’ progress. For the assessor it is also important to see which student needs more support.

4.3.1 User needs based on insights from meeting with anesthesiology

The following user needs were identified based on the meeting with anesthesiology stakeholders:

• Users value narrative feedback over scores
• Users want a comparison with peers
• Users are interested to see the difference between the assessor’s evaluation and self-assessment
• Users want to be notified when they miss milestones or appointments
• Learners need to see their own progress
• Learners need to see whether they are reaching competencies
• Assessors need to compare the learner’s level compared to expected level
• Assessors need to see the history of feedback given to a student
• Assessors need to be alerted of which students need support

4.4 JIT survey rounds 1 and 2 (Spring 2015)

Following the initial stakeholder workshops, module-specific research was carried out by technical partners to narrow down requirements for the JIT and VIZ modules.

Two rounds of surveys in Spring 2015 were used to investigate educational partners’ wishes for the JIT module. During this research activity, educational partners were presented with six suggested feedback types defined by UoR and questioned about the relevance and use for the feedback types. The first survey was a questionnaire, whilst the second consisted of a survey and an interactive prototype, which helped the respondents visualize the feedback types in practice.
4.4.1 Terminology insights

The feedback types suggested to educational partners were:

- Improvement feedback
- Positive feedback
- Supervisor feedback
- Trend feedback
- Cohort feedback
- Gaps feedback

As a result of the JIT survey, changes in terminology have been suggested by educational partners:

- Personal/Narrative Feedback (previously Supervisor Feedback)
- Match to Standards Feedback (a combination of previously suggested Improvement Feedback and an overview of norms and standards provided by educational partners)
- Group Comparison (previously Cohort Feedback) - will be covered mainly by the VIZ module
- Developmental Trend (previously Trend Feedback) - will be covered mainly by the VIZ module
- Personalized Recommendations (previously Improvement and Positive Feedback)

These change requests are further detailed in “Conclusion from JIT survey rounds, Spring 2015.” (https://www.project-watchme.eu/dokuwiki/doku.php?id=wp5:start)

Further development of the JIT module will evaluate these terminology suggestions and adjust the terms used in the JIT module in order to support users best possible.

4.4.2 General needs based on JIT surveys insights

The following insights, applicable to all tracks, were identified through the JIT survey rounds:

- Users want to see personalized feedback that informs them whether they are doing well or need to improve.
- Users want narrative feedback from Supervisors to be included in the JIT module. Supervisors’ narrative feedback is important and relevant to students.
- Users want Supervisors’ feedback to be analyzed and categorized as positive feedback or suggestions for improvement so that the messages can be presented as such.
• Users want Supervisors’ feedback to be linked to relevant EPAs so that the feedback message is easy to decipher.
• Users find Gaps feedback relevant. This feedback type will be covered by a plugin in EPASS and is therefore out of the WATCHME-project scope.
• Users are interested in seeing graphical presentations of trend feedback and cohort feedback rather than narrative presentation of these feedback types.
• Users value truly personal messages. Generic messages are of little or no value to users.

4.4.3 Filtering and navigation needs
Regarding filtering and navigation within the JIT module and between the JIT module and the remaining EPASS features, the following insights were gathered:
• Users are concerned about the amount of narrative feedback in the JIT module.
• Users expect the available JIT feedback to be relevant and based on the most recent activities and assessment.
• Users want to be able to open all feedback for a particular EPA.
• Users require easy, visible and intuitive navigation within the JIT module as well as between the JIT module and other EPASS features.

4.4.4 Track-specific needs
In addition to the general requirements, different tracks have specific requirements for the JIT module in order to tailor the module, its information and its features to the users.

The track-specific requirements include:
• Definition of scores that are considered ‘good’. This influences the feedback messages given.
• Number of EPAs and Competencies. This differs from track to track and within the track, e.g. teacher education in Tartu has 12 tasks (EPAs) while teacher education Utrecht has 11 tasks (EPAs).
• Terminology
• Language
• Relevance of feedback types

4.5 VIZ Workshop (July 22nd 2015)
In July 2015, the VIZ workshop gathered potential users from three educations in Utrecht – anesthesiology, veterinary education and teacher education – in a structured brainstorming session. The aim of this workshop was to discuss and understand how potential users imagined the visualizations to look and feel like. The workshop was facilitated by Jayway with representatives from Mateum and UM assisting the lead facilitator.
The workshop consisted of three main phases - brainstorming, analysis and sketching - and was designed to engage participants in discussions and visualization exercises.

4.5.1 User needs based on VIZ workshop insights

Based on the insights from the VIZ workshop, the following user needs have been identified:

- Students are very interested in knowing whether they are on track compared to the ‘norms’ or ‘standards’ set by the faculty.
- Some students are interested in comparing their performance to their peers in a group comparison. Other students find this comparison demotivating.
- Students are interested in saving useful feedback.
- Students want an overview of the goals that have been set for them by the faculty.
- Students want to be able to set goals for themselves and see these goals in visualizations so that they can work towards them.
- Students want to be reminded about requesting the necessary feedback from their supervisors.
- Teachers and supervisors want to know whether their grading is fair and in line with other teachers’ grading.
- Medical students (medicine, anesthesiology and veterinary education) want feedback which covers longer periods after a procedure or contact with a patient.
- Students want feedback on their interpersonal skills.

4.6 VIZ Feedback Sessions (October 2015)

During the development of the VIZ module, a feedback session was scheduled to validate the prototype and guide the further development process. Feedback sessions were held with each track in Utrecht individually in order to identify differences between the different tracks' requirements. Feedback sessions were designed differently to suit the number of participants and time allocation for each track.

4.6.1 User needs based on feedback session insights

The most important user needs identified during feedback sessions include:

- The EPA and Competency structure as well as the education and internship structure of each track must be reflected in the VIZ module. Thus:

---

5 Of the requirements and user needs identified in the workshop, some have been found to be outside the scope of the WATCHME-project and have thus been saved as ideas for later development of the EPASS system. These are indicated by *. Some of the requirements and user needs have been defined as adjustments and improvements in EPASS and are not within the WATCHME-project. These are indicated by **
Veterinary education operates with 7 blocks (time periods)
- Different EPAs are evaluated during different blocks. Same EPAs can be evaluated in several blocks.

Veterinary education has three levels of EPAs: EPAs, Competencies and Sub-competencies.

Undergraduate medicine operates with 6 clerkships
- In clerkships 1-5, SubEPAs are evaluated while EPAs are evaluated in clerkship 6.

Undergraduate medicine has three levels of EPAs: EPA, SubEPAs and Competencies.

Anesthesiology wishes to see 12 months of data as a default.

Undergraduate medicine and Veterinary education wish to see current clerkship/block as default, with the option to go to a previous clerkship/block.

Teacher education requires a separate visualization for the questionnaire on teacher interactions (QTI).

- Users require easy navigation and a clear indication/explanation of which visualization they are looking at.
- Users need personal information. Generic information is neither useful nor relevant.
- Color-blind users must be able to decipher the visualizations and differentiate between elements in the visualizations.
- Users want to know how close they are to achieving a passing score.
- Users need definitions of terminology so that they understand all EPAs, competencies and levels.

4.7 Expert interviews (November 2015)

The different expert interviews resulted in a concept map identifying the different educational theories and concepts to be considered when designing the student model. Based on these theories and concepts seven possible ‘knowledge fragments’ were identified that could be included in the student model:

- **need for feedback**: depending on the stage of development learners need different supervision styles and different feedback. This requires an adaptation to the stage of the development; the identification of stages in the development and definition of supervision styles.
- **Feedback seeking behavior**: not all learners seek the most appropriate feedback, for instance they always ask feedback to the assessor that is most favorable in his/her assessment. This requires the identification of patterns in feedback seeking behavior, defining categories of assessors, and identifiers for mildness of assessors.
• **Frustration alert:** this refers to recognizing signals that point to a lack of engagements, such as for instance poor feedback seeking behavior, sudden dropping of scores; drop in portfolio usage. This requires the identification of these signals and usage statistics of the user.

• **Completeness of information:** help students or supervisor to detect areas in which too little information is collected. This requires the definition of areas (competency, EPA) and what a normal level of information is.

• **Self-efficacy:** when students do not react to assessment feedback this can point to a lack of self-efficacy, which in turn may influence student’s learning. An identifier could be that students do not improve after given them improvement feedback. Students with a low level of self-efficacy may need specific attention. The supervisor needs to get an alert when there are signs.

• **No response to feedback:** when the same feedback messages are repeated the student apparently does not response to it by a change in behavior. This requires to be able to identify a repetition of feedback messages, in addition it also requires the identification of a time span to check for repetition.

During a technical meeting on December 14th 2015 it was decided that the latter two elements are not feasible within the project. The first four will be further investigated (see requirements table in annex 1).

5. **Description of the data that has to be collected for the user modeling**

5.1: **EPASS data content description**

The information that is available in EPASS has been described on a generic level as an ontology of classes and attributes in Appendix 1 of deliverable 3.2 (system architecture). The content of the portfolio differs per domain and per partner. The detailed specifications of configurations for each domain are provided in deliverable 3.5.

5.2 **Student Model input data**

This subsection summarizes the data gathering requirements that have been defined previously in the WATCHME deliverable D4.2.

5.2.1 **Basic Student Model data access**

The Student Model requires access to the basic student model data that is stored in EPASS in order to manage the user identity (through an abstract identifier) and the association of students to training modules. The required information for the Student Model consists of:

• unique student identifier
5.2.2 Feedback submission data access

The Student Model requires access to all EPASS submissions that are provided for a user. EPASS will forward any EPASS submissions to the Student Model using a generic data structure with the following elements for individual responses:

- answer
- submission the answer is part of
- form item identifier
- form item response value (either string or integer value depending on the feedback type)

In addition to the response data, EPASS will need to provide a set of metadata at the level of submissions:

- competency-subcompetency mapping
- targeted EPA of a submission
- list of labels for updating Bayesian model nodes

In addition to the generic content data that is required as the actual content for instantiating and updating Student Model data for students, the Student Model furthermore requires mapping data that map submissions through EPASS input forms into input data for updating an individual student data model.

For Multi-Source Feedback (MSF), the Student Model needs to use the aggregated data that is computed by the EPASS system in order to remain consistent with the EPASS presentation (e.g. in terms of presenting identical aggregated score values).

5.2.3 Student Model structure data access

The structure of the Bayesian Network used for each of the partners involved in the tracks of the WATCHME-project needs to be defined individually for each partner. To this end, the relevant partners must provide the relevant EPAs and dependent data relations so that they can be modeled in their individual Bayesian Model. Partners need to provide this information in a structured format as responses to a questionnaire; any changes or updates to the structure used by a partner organization must be followed up with an update of the data model description.
6. Description of the data that is needed to produce Just-in-Time feedback

Based on a survey with different stakeholders, a number of requirements were defined for the just-in-time feedback module.

With respect to the general design it was decided that the JIT component will have to levels of feedback (level 1 vs level 2). Level 1 will display the aggregated conclusion of the EPA and Level 2 will detail improvement strategies for each competency / performance Indicator.

The JIT component will be displayed as a plugin of the dashboard. Level 1 will be displayed on the front page of the EPASS dashboard for all the relevant EPAs. Navigation elements (e.g. Buttons) will allow navigation to Level 2 for the selected EPA. The JIT component will also be displayed as a plugin in the Assessment Forms and will display Level 1 and Level 2 feedback.

First some general requirements are provided followed by specifications for each track. Within the description of each track also requirements with respect to language issues are discussed.

6.1 Requirements for the Feedback messages

- **Improvement** and **Positive Feedback** will be merged in the same category, called **Personalized Feedback**. The Student Model will treat these messages differently, but the Students will notice only the most relevant feedback message, which will present improvement suggestions.

- **Supervisor Feedback** will be processed and integrated into the Student Model and JIT component as one of the priorities for all the partners. Initially, The Student Model will associate the narrative feedback given by the supervisor with an EPA. Further development of the Student Model will use language analysis and keyword recognition to determine whether feedback is ‘positive’ or ‘improvement’ and attach supervisors’ messages to certain competencies/performance indicators.

- **Gaps and room for improvement Feedback** message will be solved by a newly developed EPASS plugin. In this context, adding a new feedback message in the JIT model is not useful at the moment.

- **Cohort Feedback and Trend Feedback** are more suitable for a visualization. These two feedback types will be included in work carried out on the VIZ module.

6.2 Filtering and navigation strategies

- **Number of EPAs – Level 1**: There was a general concern that the number of tasks displayed on the dashboard will be too high and will confuse or overwhelm the students.
Deliverable 3.1: Requirements document

The suggested solution is to select the three most relevant EPAs/Tasks (tasks that were recently updated and EPAs/Tasks addressed by most recent assessments) and the three EPAs/Tasks where the least or no activity has been done recently.

- **Selection and visualization of feedback for one EPA:** The JIT component will also include the possibility to select one EPA and receive all the feedback (Level 2 Feedback) for the selected EPA.
- **Navigation:** The navigation will be improved and the home/back button will be moved into the JIT Component.

6.3 Specific requirements for each track

6.3.1 Teacher Training Track

- **Rubric:** The teacher training track has already developed a rubric, available on the wiki. This rubric will be the foundation of the new Personalized Suggestions matrix, used by the JIT model.
- **Position on dashboard:** All the TT partners seem to agree about the position of the new component, without any major remarks.
- **Number of EPAs – Level 1:** There was a general concern that the number of tasks displayed on the dashboard will be too high and confuse the students. The suggested solution was to select the three most relevant EPAs/Tasks, i.e. tasks that were recently updated and EPAs/Tasks addressed by most recent assessments and the three EPAs/Tasks where the least or no activity has been done recently.
- **Selection of messages – Level 2:** The most relevant message types are Improvement Feedback (Personalized Feedback) and Supervisor Feedback. Gaps feedback will be addressed by the new EPASS plugin. Trend feedback will be addressed by VIZ and Cohort comparison is not relevant for teacher training education.
- **Selection of positive vs improvement feedback:** In teacher training, certain levels are considered good (level 3) and therefore the automatic feedback messages for students who have reached this level or higher ought to be more positive.
- **Teacher training Utrecht vs teacher training Tartu:** There are a few differences at portfolio configuration level between the two partners (Tartu has 12 tasks and 5 levels, whilst Utrecht has 11 tasks and 4)
- **Languages:** The feedback messages, Personalized Suggestions matrix will be available in English, Dutch and Estonian. English and Dutch will be used and developed by teacher training Utrecht. Estonian will be used and developed by teacher training Tartu.

6.3.2 Veterinary Training Track

- **Rubric:** Veterinary training track has already developed a preliminary rubric in Dutch. This rubric will be the foundation of the new Personalized Suggestions matrix, used by the JIT model. Additional information could be added to the rubric later, when the veterinary education track rubric will be ready.
Deliverable 3.1: Requirements document

- **Position on dashboard**: There was a major concern that the users will be confused by the newly added features. All the VT partners agreed that this should be evaluated in the pilot study and if the users will provide negative feedback regarding the position of the JIT component on the dashboard, this will be addressed in the design process.

- **Number of EPAs – Level 1**: There was a general concern that the number of tasks displayed on the dashboard will be too high and will confuse the students. The suggested solution was to use the same strategy as for Teacher Training.

- **Selection of messages – Level 2**: The most relevant message types are the Improvement Feedback (Personalized Feedback) and Supervisor Feedback. Gaps feedback will be addressed by the new EPASS plugin. Trend and Cohort feedback will be addressed by VIZ.

- **Veterinary education Utrecht vs Veterinary education Budapest**: There no major differences between the two portfolios and JIT configurations.

- **Languages**: The feedback messages, Personalized Suggestions matrix will be available in English, Dutch and Hungarian. English will be developed by the technical partners and will be used in the development process. Dutch will be used and developed by U. Utrecht. Hungarian will be used and developed by SIU.

6.3.3. Undergraduate Medical Training and Anesthesiology Track

- **Rubric**: All the medical domain partners are still working on the rubric and there is no version available at the moment.

- **Position on dashboard**: No comments on the position on the dashboard.

- **Number of EPAs – Level 1**: There was a general concern that, the number of tasks displayed on the dashboard will be too high and will confuse the students. The suggested solution was to use the same strategy as for Teacher Training.

- **Selection of messages – Level 2**: The most relevant message type is Supervisor Feedback. Improvement Feedback can be developed when the rubric will be available. Gaps feedback will be addressed by the new EPASS plugin. Trend and Cohort feedback will be addressed by VIZ.

- **Differences between various partners**: There are some differences between the portfolios and future discussions will be scheduled to agree on other potential tools to be used by the Student Models.

- **Languages**: The messages are already in the local languages of the student since only the supervisor feedback seems relevant at this point.

- **Terminology**: There was a quick discussion with the UMCU partners about the taxonomy and concepts used in the project, especially by the partners involved in the JIT development:
7. Description of the data that is needed to produce visualizations

Whereas JIT feedback informs students about their most recent assessments and provides feed-forward with advice on how to achieve the next level, VIZ feedback visualizes the student’s current performance and development history.

- In order to be suitable for all educational partners, as a first requirement the VIZ module should be able to request a track definition for a particular education, e.g., for a teacher education what professional roles, EPAs or tasks, and performance indicator exists.
- **Timeline view:** this shows how the student has developed in the last week, month, year. Exact timeframes, between which the users can zoom in and out, are yet to be defined with each educational partner, for some educational programs is may be better to provide students with a timeline of a whole semester, for others it may be better per week. This means that the VIZ should allow for performing queries on EPA level, student level, assessment level, and period in time. The timeline can be explored on different levels – on EPA and Competency level - depending on the educational partner. E.g., for teacher education, the timeline will exist on three levels: Professional Roles, Tasks, and Performance Indicators. Users can dive further into the level or step out of the level through interaction with the visualization.
- **Cohort view:** the VIZ should be able to show the development history of a specific cohort and should be able to compared a single student to a cohort or a group.
- **Current view.** The current view shows visualizations of the students’ current performance aggregating data from the most recent assessment forms. Similarly to the timeline view, the current view will allow students to dive into the 2 or 3 EPA levels, depending on how many the educational partner uses. Currently, spider and column diagrams are being developed with the intention to evaluate them with users and choose the most appropriate one or both. Current view diagrams will be interactive as user can indicate their desired score and receive JIT advice on how to achieve the desired score. Additionally, the VIZ should allow to see the differences between different types of assessment, for instance between a self-assessment and a supervisor’s assessment.
- **Platform:** the VIZ module should be implemented as a web solution that should not have special preferences as to the user platform, i.e., VIZ should be supported on desktop, tablet and mobiles devices.

Data for the Timeline and Current views is gathered through EPASS assessment forms. EPASS calculates the aggregates and provides data to the JITVIZ API, which produces visualization displayed in EPASS. Data for advisory messages – e.g., The JIT message in the Current view – is received from the Student Model.
8. Portfolio and Student Model data exchange requirements

This chapter provides a high-level overview of functional requirements for the connection between portfolio and Student Model server systems. The required interfaces have been implemented and tested; the results of the requirements analysis process can be viewed in the WATCHME deliverables D3.2 and D4.1.

8.1 Data communication requirements

All portfolio data is managed through the EPASS system; only the EPASS system stores the relevant portfolio data as well as the necessary student data. The overall functional goal to be expressed by the functional requirements for the connection between portfolio and student model server is the provisioning of data from the portfolio database to the Student Model for processing.

The Student Model should represent pseudonymized student data (where students are identified through a unique identifier (ID) and the result of student data processing only and should not store e.g. actual student feedback data (see also Chapter 11). In principle, EPASS must send portfolio updates to the Student Model server at least on a nightly basis. Any updates will be anonymized as much as possible in an automated way and a system for privacy enhanced user identities must be applied by EPASS in order to protect student identity. The data processed by the Student Model Server will be erased immediately after the update was taken into account. Whenever EPASS signals the SM that a submission has been invalidated, the SM will erase the existing models and request a new image of the student protocol.

The following overall requirements need to be implemented as part of the data communication between the EPASS server and the Student Model server:

- Portfolio data must be communicated using a generalized JSON-based data format that can be universally used to communicate all types of feedback data.
- Personal user data must be discarded from the Student Model server after processing and may not be retained as persisted student model data.
- Data that is changed in the EPASS server must be communicated to the Student Model server; the Student Model server must then discard any processing results based on data that was changed subsequently.
- When users delete their complete profile in EPASS, the Student Model will also remove any information that is directly connected to those users.
- Portfolio data for which the time period to which it applies must be annotated with data concerning the applicable time period or it must be submitted during the time period to which it applies.
As indicated in the introduction to this chapter, many of these requirements have been addressed in the first prototype of the relevant WATCHME components; the WATCHME deliverables D3.2 and D4.3 report on the overall system architecture and the Student Model server implementation respectively. D4.3 also contains a more detailed specification of the required data format.

### 8.2 System communication requirements

EPASS and the student model system will be available as two software implementations that operate independently in appropriate server environments. This means that in order to integrate them, it is necessary to specify the requirements to both systems need to adhere to for any communication between each other.

The following requirements have formed the underlying framework for the implementation described in D3.2 and subsequently carried out in the project:

- A **RESTful web service** API should be provided by both the EPASS server and the Student Model server system in order to facilitate communication and data exchange.
- The two server systems must be able to provide and receive data in batches as the output of overnight system processing.
- The EPASS API that provides user data must be protected and access must be restricted to authorized requesters.
- All communication between the EPASS server and the Student Model server must be encrypted.
- A notification endpoint to which EPASS can notify of changes to data that has already been processed must be provided by the Student Model server.

As part of the first system prototype version, the integration of the EPASS and Student Model server at communication level has been completed. It is not anticipated that the communication with the EPASS server will change at the communication level in upcoming prototype versions.

### 9. Functional requirements of integration of JIT feedback and visualization in the portfolio

Users request a just-in-time feedback message through the EPASS user interface. To this end, EPASS either offers widgets (provided by the JIT/VIZ UI) within the EPASS GUI or forward requests to the JIT/VIZ API. This module communicates with the SM API to collect an appropriate feedback message for the user and delivers this data inside a JIT/VIZ UI widget that is integrated into the EPASS UI.

Similarly, users request visualizations through the EPASS interface, via widgets provided by the JIT/VIZ UI. Whenever the user engages a visualization session, the JIT/VIZ module
gathers aggregated data as needed from EPASS portfolio database via the EPASS API and from the SM via the SM API. The SM module in combination with the EPASS API take care that users are not allowed to visualize data for which they do not have access rights. This should include statistical intractability (e.g. small numbers).

To offer data to the JIT/VIZ, a REST API is used that offers (aggregated) data on request. In principle the API will follow a structure that is based on class skeletons (D3.2, appendix 1). The EPASS API will use hash codes with a limited time span to replace user IDs in communication with SM and JIT/VIZ.

10. Requirements concerning server and end user platform

In general, the three modules: EPASS, the Student Model module and the JIT/VIZ module all have their own REST API that each communicate with their peer APIs (see D3.2). A general data language is developed that describes how portfolio information is translated in order to be transported between APIs. Next to the three modules, a central authentication server, based on OAuth, will be included that arranges secure authentication between the three modules.

The student model and JIT/VIZ modules are envisioned here to reside on one physical server separate from the EPASS server. The architecture of the student model module is explained in further detailed in D4.1. The user interface of the JIT/VIZ module is, from the perspective of the user integrated into the EPASS user interface (see D5.1).

EPASS sends portfolio updates to the student model server (SM) on a nightly basis. These updates are anonymized as much as possible in an automated way, and a system for privacy enhanced user identities is applied. The data processed by the Student Model Server is erased immediately after the update has been taken into account. Whenever EPASS signals the SM that a submission has been invalidated, the SM will erase the existing models and request a new image of the student protocol. This sequence is described in more detail in the Student Model API section in D3.2.

11. Requirements concerning performance, usability, quality and availability

The following list of requirements are also the results of data collected through different workshops and meetings with the educational partners and stakeholders (see Table 1). The WATCHME extension to the e-portfolio system should:

- Integrate seamlessly into the e-portfolio user interface, with regard to e.g. visual layout, terms and concepts used, navigation style.
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- Should nevertheless be recognizable as "the WATCHME addition" in order for users to be able to evaluate this extension.
- The WATCHME extension should not hinder normal functionality of the e-portfolio.
- Performance for Just-in-Time feedback should be such that the response times are limited to three or four seconds between request and display of feedback.
- The actual quality of the content of feedback produced is to be evaluated in work-package 6, but the feedback should at least make sense to the end user.
- Narrative feedback should preferably be presented in the domains’ natural languages.
- Visualizations should appear within two seconds after request.
- Interpretation and manipulation of visualizations by end users should be self-explanatory, no manual should be necessary.
- The actual quality of the content of visualizations presented is to be evaluated in work-package 6, but should at least make sense to the end user.

12. Requirements concerning security and privacy

Different technical aspects of EPASS are described in the following paragraphs.

12.1 Portfolio access and protection of privacy

Learners are the owners of their portfolio. A learner can grant access to the portfolio to different persons, for example residency program directors, mentors, supervisors or other people. Normally, it is desirable that persons who need to track the progress of the learner will have (temporary) access to all the information in the complete or a specified part of the learner's portfolio. The learner has an overview of persons that have been granted access to their portfolio, with the begin and end date of their access and specified to what part they have access, e.g. complete portfolio or sub-part (e.g. one clerkship, participation or elective education). When a learner has granted someone access to his/her portfolio, the learner can always change the grant. In this way, it is possible to deny access again by setting a date in the past.

Persons who don't have portfolio access are only able to the assessment forms, which are filled out by themselves.

Assessors who have not been granted access to the portfolio can view only their own assessments and not those from others.

The secure connection with the system prevents interception of portfolio data. Both the central and local system management are bound to strict secrecy. The data collected through EPASS can be used for research purposes but only if the data is anonymized for the researchers.

The Privacy Manager API will deal authorization/privacy requests such as: is user 'XXX' allowed to receive JIT messages about user 'YYY' within section 'ZZZ'?

For ‘XXX’ and ‘YYY’ the user hashes are used. For ZZZ, the session token from EPASS will be used.

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EPASS uses four types of administrator roles:

1. System admin: has access to the data of all users
2. Region admin: has access to the data of all users within a certain region or otherwise defined subgroup of users (with the exception of data of other administrators)
3. Hospital/institution admin: has access to the data of all users within a certain (own) specialty or small track within an institution (with the exception of data of other administrators)
4. Specialty/education admin: has access to the data of all users within a certain (own) specialty or small track within an institution (with the exception of data of other administrators).

Administrators have access to the portfolio of learners, education data and are able to reset account information. Administrations have no access to personal passwords. System admins have, next to the before mentioned accesses, also the functionality to take over the account of any user. Use of this functionality, as any other use in the system, is logged.

EPASS falls under the Dutch law of protection of personal data and follows an information security policy based on ISO-norms (e.g. ISO27001).

12.2 Security

The safety of EPASS is ensured as far as possible. The system is protected at several levels:

- Every user receives a password which can be personalized in order to prevent post-it’s with difficult passwords written on it.
- The data traffic between PC’s and the central system is conducted via secure connections (SSL; Secure Sockets Layer), recognizable at the ‘https’ in the address bar and the lock icon at the bottom right of the internet browser.
- Data is saved on a secured server in a data center by Pine Digital Security; a company which is specialized in internet security.
- All access to that server and the EPASS database (for maintenance purposes) is strictly secured.
- A strict back up regime is conducted, in which backups are stored encrypted.

Authentication and authorization are already concerns on the portfolio system. With JIT and VIZ being embedded into the portfolio system’s user interface, it is natural to propagate authentication and authorization concerns for the JIT/VIZ modules to the portfolio system as well. After authenticating a user in the hosting portfolio system, it will pass an opaque session context to the components embedded within it. This context, validated by the portfolio system, will propagate, as a token passed to the JIT/VIZ controllers, to all requests made against the
JIT/VIZ API interfaces. From there, propagation continues to the underlying portfolio system and SM APIs (in the latter case, propagation continues to the portfolio system), where the token is ultimately verified to ensure that that requests being made against them are allowed in the given context (authorization). Information privacy is handled at the transport level (i.e. by TLS/SSL) (see also D3.2)

12.3 Database

EPASS uses MySQL, a widely used open-source database, which is well suited to large-scale web-based applications. The quality of the system’s performance is guaranteed by the technology that is used (PHP) and the design of the database and the system, including data warehousing. When the number of users and functionalities increases, the platform and the architecture allow for expansion of the hardware; without necessitating software adjustments.

EPASS is provided as a SAAS (Software as a Service). The system is hosted by Pine Digital Security. The data is stored on a database at this company as well.

13. Requirements concerning management and maintenance

The management of the system is done partially by the educational partners and partially by Mateum. For the user administration each educational partner has received one or more administrator accounts. With these admin accounts the educational partners can manage their users and make changes in assessment forms or devalidate them. These administrators are also the first line support for users from an educational partner. For changes in student portfolios that can be done by a regular administrator or for questions about the system the educational partners can’t answer, Mateum provides a second line support via email or phone.

Since EPASS is a SaaS solution the maintenance for the system is done by Mateum. The maintenance of JIT/VIZ and the Student Model is done by Jayway respectively by University of Reading. EPASS knows a 6 to 8 weeks update cycle. This means adjustments to the system requested by the educational partners can only be done during these updates when the complete system goes offline. Only in case of bugs with a high impact a hotfix will be provide to solve the issue immediately. Since the JIT/VIZ components and Student Model are on a different server, updates of those parts of the system can be done when needed, independent from the EPASS updates.

To maintain the Learning analytic module during and after the project it is important that both JIT/VIZ and the student model are configurable. There should be clear instructions what steps are needed to add or edit an education, EPAs, forms, and performance indicators. To extend or add functionalities it is necessary that all the source code has good documentation and comments and that where it is possible functionalities are covered by automated unit tests. In the final version of this deliverable at the end of the project the minimal server requirements for both hardware and software will be determined based on the outcomes of the evaluations.
14. Closing summary

Collecting information about the user’s need was an intensive task, and resulted in a longlist of requirements, including specifications depending on the track the users are in. Although, the obtained list provided valuable insight, but from a technical point of view it was necessary to go a step further and develop together with educational experts the requirements on another level. Not what needs to be viewed by supervisors, students, or other stakeholders, but what are the requirements for the model behind the JIT and VIZ module. This resulted in a list of requirements, of which some are now beyond the scope given that they are a research project on themselves. Therefore the need is created to address additional elements after the WATCHME-project.

One of the main priorities are that for the users the additional information they receive within their portfolio, through the JIT and VIZ-module:

- reflects the student’s learning process,
- is easily accessible and understandable,
- is up to date,
- adds to the information they can receive in each individual assessment form, and
- helps supervisors to make decisions with respect to entrustability.

15. References


### 16. History of the document

#### 16.1 Document history

<table>
<thead>
<tr>
<th>Version</th>
<th>Author(s)</th>
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<td>UM</td>
<td>14/10/2014</td>
<td>Revision on 26/11/2015</td>
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<td>0.2</td>
<td>UM, Mateum</td>
<td>6/02/2015</td>
<td>Input for first two chapters</td>
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<td>UM –internal</td>
<td>29/03/2015</td>
<td>Restructuring, adding info for first two chapters</td>
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<td>0.4</td>
<td>UM-Mateum</td>
<td>02/07/2015</td>
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<td>Revision and entering of information from different sources</td>
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<td>0.6</td>
<td>UM</td>
<td>25/09/2015</td>
<td>Integration of comments made by all reviewers</td>
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<td>0.7</td>
<td>UM</td>
<td>20/11/2015</td>
<td>Pre-final version, especially additional information on VIZ-module</td>
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<tr>
<td>Final</td>
<td>UM</td>
<td>19/12/2015</td>
<td>Final version with some additional input from Mateum (chapter 13)</td>
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### 16.2 Internal review history

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<tr>
<td>Jeroen Donkers (UM)</td>
<td>20/07/2015</td>
<td>Fine tuning of the structure, inclusion of user’s needs study</td>
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<tr>
<td>Denise Janssen &amp; Martijn Holthuijsen (Mateum)</td>
<td>15/09/2015</td>
<td>Revision and information input</td>
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<td>Ovidiu Serban (UoR), with input from NetRom</td>
<td>22/09/2015</td>
<td>Partly reviewed, input Netrom for section 9</td>
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<td>Natali Barbour (JayWay)</td>
<td>22/09/2015</td>
<td>Reviewed and information input on visualization</td>
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<tr>
<td>Joyce Moonen (UM)</td>
<td>28/09/2015</td>
<td>reviewed and input on security issues</td>
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<tr>
<td>Rik Wijnen (Mateum)</td>
<td>07/10/2015</td>
<td>Reviewed and information input on EPASS; the system and privacy issues</td>
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<tr>
<td>Marco Tiemann (UoR)</td>
<td>10/11/2015</td>
<td>Input for part 4.2, part 5 and suggestion change in title op part 7</td>
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<td>Natalia Bourbon &amp; Mads Eneveldson (JayWay)</td>
<td>17/11/2015</td>
<td>Additional input for 3, 5 and 6, first draft of table in annex 1</td>
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<td>Sylvia Walter</td>
<td>24/11/2015</td>
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<td>Marieke van der Schaaf</td>
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<td>Natalie Bourbon</td>
<td>09/12/2015</td>
<td>Rewritten part on feedback session for VIZ</td>
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</table>
Annex 1: Requirements table

Legend:

**Type:** Specifies the type of the requirement, whether it is a general requirement or a requirement related to a specific target user.

**ID:** ID given to the requirement to ease communication and referencing between user requirements and data requirements.

**Topic:** Main topic of the requirement.

**Actor:** for which user is this relevant

**Requirement:** Description of the requirement and the user to whom the requirement is relevant.

**Interface:** Module within which the requirement will primarily be covered. Requirements tagged ‘All components’ are relevant for JIT, VIZ and EPASS. (EPASS is listed as a relevant interface for the requirement in cases where JIT and VIZ cannot address the requirement without correlating adjustment of EPASS. However, it is important to highlight that the project scope is centered on JIT and VIZ only and should not require general changes in EPASS. Adjustments in EPASS ought to be restricted to JIT, VIZ and SM integration as well as EPA-related adjustments.) The interface column lists only where the requirement will be visible to the user. Behind each user requirement lies the data requirements specifying data flow from EPASS and SM to the JIT and VIZ module.

**How:** short indication on how to realize this requirement

**Version:** 1.0 means before the first of March, 2.0 means that this is planned for after March (to be ready for summative evaluation), OoS means Out of Scope for the project.
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<tr>
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<th>Requirement</th>
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<tr>
<td>M-Req-1</td>
<td>General</td>
<td>Pedagogy</td>
<td>Student/Supervisor</td>
<td>Take preference for certain feedback type into account</td>
<td>SM</td>
<td>The SM takes the stage of development into account to determine supervision style preference and feedback type.</td>
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<tr>
<td>M-Req-2</td>
<td>General</td>
<td>Pedagogy</td>
<td>Student/Supervisor</td>
<td>Feedback on feedback seeking behavior</td>
<td>SM</td>
<td>The SM detects flaws in feedback seeking behavior. In v1.0 a student will be able to see in a visualization from whom received feedback (peer, assessor, supervisor). Refinement of this requirement will be investigated for the next version.</td>
<td>V1.0 (start), further elaboration in v2.0</td>
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<td>M-Req-3</td>
<td>General</td>
<td>Pedagogy</td>
<td>Student/Supervisor</td>
<td>Frustration alert</td>
<td>SM</td>
<td>The SM detects signals of lack of engagement. A first indicator that will be looked at is the sudden dropping in scores (see also V-req-6).</td>
<td>V1.0, further elaboration in V2.0</td>
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<tr>
<td>M-Req-4</td>
<td>General</td>
<td>Pedagogy</td>
<td>Student/Supervisor</td>
<td>Point to missing information</td>
<td>SM_ViZ</td>
<td>The SM detects areas in which too little assessments are collected. This will be shown in the ViZ, students/supervisors can deduce this themselves; in a further version it will be investigated how messages can be deduced.</td>
<td>V2.0</td>
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<tr>
<td>M-Req-5</td>
<td>General</td>
<td>Pedagogy</td>
<td>Student/ Supervisor</td>
<td>Feedback on portfolio consistency</td>
<td>SM -VIZ</td>
<td>THE SM analyses level of consistency in assessments and detects odd regions. This will be shown in the VIZ, students/supervisors can deduce this themselves; in a further version it will be investigated how this</td>
<td>V2.0</td>
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<td>M-Req-6</td>
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<td>Pedagogy</td>
<td>Student/ Supervisor</td>
<td>Lack of self-efficacy alert</td>
<td>SM</td>
<td>SM analyses behavioral responses to feedback messages</td>
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<td>M-Req-7</td>
<td>General</td>
<td>Pedagogy</td>
<td>Student/ Supervisor</td>
<td>Lack of change alert</td>
<td>SM</td>
<td>SM detects whether certain assessor feedback is repeated over time</td>
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#### JIT-requirements

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<th>How</th>
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<tr>
<td>J-Req-1</td>
<td>Specific user</td>
<td>Performance of EPAs and competencies</td>
<td>Student</td>
<td>information about performance on particular activities.</td>
<td>JIT</td>
<td>If educational partners need more personal/detailed info, they have to provide detailed rubrics. This will be further discussed with the educational partners</td>
<td>V2.0</td>
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<tr>
<td>J-Req-2</td>
<td>Specific user</td>
<td>Feedback messages from supervisors</td>
<td>Student</td>
<td>see feedback and messages from my supervisor.</td>
<td>JIT</td>
<td>Already functioning. Right now, you see by default the narrative feedback of the last feedback form. Maybe an option to show more narrative messages. SM can see which messages are longer and more opinionated, and feedback that is positive, negative or neutral. Rule: Message with most sentiment from the last 3 assessment forms of an EPA.</td>
<td>V2.0</td>
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## Deliverable 3.1: Requirements document

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<td>Specific user</td>
<td>In-depth information</td>
<td>Student</td>
<td>Insight in the reasoning and reflections behind grades.</td>
<td>VIZ</td>
<td>Students can go to assessment forms to see feedback behind numeric grades. Up to supervisor to explain their grading.</td>
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<td>J-Req-4</td>
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<td>Categorization of feedback</td>
<td>Student</td>
<td>Logical categorization of feedback</td>
<td>JIT</td>
<td>Supervisor/narrative, personalized/improvement,</td>
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<td>Feedback query</td>
<td>All users</td>
<td>Possibility of query on level 1 feedback for all EPA’s</td>
<td>JIT</td>
<td>Student model API – Already in place + We display by default the three latest assessed EPAs. For each one of the three, we show a supervisor message and improvement feedback.</td>
<td>V1.0</td>
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<tr>
<td>J-Req-6</td>
<td>General</td>
<td>Feedback query</td>
<td>All users</td>
<td>Possibility of query on level 1 and 2 feedback for given EPA</td>
<td>JIT</td>
<td>Student model API – Already in place + We display rubric information per competency/performance indicator and we want to display the most sentimental supervisor feedback message. To be changed after march. Jayway needs to call correctly. Jayway will look into it.</td>
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<td>All users</td>
<td>Filter messages types on a given EPA query</td>
<td>JIT</td>
<td>Student model API – Already in place: verifying correct feedback type. Jayway will look into adjusting this after march.</td>
<td>V1.0 – adaptation V2.0</td>
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<td>ID</td>
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<td>J-Req-8</td>
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<td>Feedback level 2</td>
<td>student</td>
<td>Personalized improvement strategy</td>
<td>JIT</td>
<td>This requires adding a new field in EPASS forms where supervisors can write advice specifically on improving OR educational partners have to provide improvement feedback options that supervisor can choose from in check boxes. Maastricht will talk to educational partners.</td>
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<td>J-Req-9</td>
<td>Specific user</td>
<td>Feedback narrative</td>
<td>student</td>
<td>Supervisor narrative feedback in JIT</td>
<td>JIT</td>
<td>SM API must allow for retrieval of this information. For each level of a competency retrieve assessments related to each level. Related to J-Req-2</td>
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<td>J-Req-10</td>
<td>Specific</td>
<td>narrative</td>
<td>student</td>
<td>Analyze and categorize text to highlight negative and positive things</td>
<td>VIZ</td>
<td>NLP. Sentiment analysis: qualifier and what is being qualified. Domain specific keywords will be prioritized (once the terms from partners arrive). Version 1.0 will contain random sentiments that will be shown in VIZ. Version 2.0 will use prioritization mechanism according to for instance frequency of use, position within the narrative and domain-specific terminology.</td>
<td>V1.0, adaptations for v2.0</td>
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<tr>
<td>V-Req-1</td>
<td>Specific user</td>
<td>Development over time</td>
<td>Supervisor</td>
<td>an overview of each student’s development over time</td>
<td>VIZ</td>
<td>Supervisor has access to the student’s timeline visualization. Every assessment form is stamped with the date it has been submitted. Version 1.0</td>
<td>V1.0</td>
</tr>
</tbody>
</table>
## Deliverable 3.1: Requirements document

<table>
<thead>
<tr>
<th>ID</th>
<th>Type</th>
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<tbody>
<tr>
<td>V-Req-2</td>
<td>Specific user</td>
<td>Current performance</td>
<td>Supervisor</td>
<td>an overview of my students’ current performance.</td>
<td>VIZ</td>
<td>Work required to find possible solutions for this requirement.</td>
<td>V2.0</td>
</tr>
<tr>
<td>V-Req-3</td>
<td>Specific user</td>
<td>Current performance</td>
<td>Supervisor</td>
<td>an overview of each student’s current performance.</td>
<td>VIZ</td>
<td>Supervisor has access to the student’s current performance visualization.</td>
<td>V1.0</td>
</tr>
<tr>
<td>V-Req-4</td>
<td>Specific user</td>
<td>Norms / standards / goals</td>
<td>Supervisor</td>
<td>Comparison between students’ performance and goals set</td>
<td>VIZ</td>
<td>Covered by V-Req-4 – current performance, comparison to passing score. There is no mechanism in EPASS for students to set their own goal. Educational partners need to inform us if setting own goals adds value. Only valuable if you have really motivated students.</td>
<td>V2.0</td>
</tr>
<tr>
<td>V-Req-5</td>
<td>Specific user</td>
<td>History of feedback</td>
<td>Supervisor and entrustment-responsible supervisor</td>
<td>History of feedback given to a student.</td>
<td>VIZ</td>
<td>Requirement already fulfilled by EPASS. Visualizations will be added to the current overview of a student’s performance. v1.0. Overview table of passing scores achieved (ready for entrustment assessment) will also be added to the overview the supervisor can see. (v1.0)</td>
<td>V1.0</td>
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<tr>
<td>V-Req-6</td>
<td>Specific user</td>
<td>Outlying students</td>
<td>Supervisor</td>
<td>Indication of students needing special attention</td>
<td>VIZ</td>
<td>Related to knowledge fragment (M-Req-3)</td>
<td>V1.0, indication of scores dropping, further development in V2.0.</td>
</tr>
<tr>
<td>V-Req-7</td>
<td>Specific user</td>
<td>Development over time</td>
<td>Student</td>
<td>development over time.</td>
<td>VIZ</td>
<td>Same as V-Req-2: Student has access to their own timeline visualization. Every assessment form is stamped with the date it has been submitted. Version 1.0</td>
<td>If time permits before v1.0, otherwise version 2.0.</td>
</tr>
<tr>
<td>V-Req-8</td>
<td>Specific user</td>
<td>Group comparison</td>
<td>student</td>
<td>to compare performance to peers.</td>
<td>VIZ</td>
<td>Only relevant for some tracks. Nice to have in v1.0, must have in v2.0</td>
<td>V2.0</td>
</tr>
<tr>
<td>V-Req-9</td>
<td>Specific user</td>
<td>Comparison</td>
<td>Teacher education student</td>
<td>compare pupil’s assessment to own perception of performing.</td>
<td>VIZ</td>
<td>V1.0 pending approval from UoR. Natalia discuss with Marco.</td>
<td>V1.0</td>
</tr>
<tr>
<td>V-Req-10</td>
<td>Specific user</td>
<td>Norms / standards / goals</td>
<td>student</td>
<td>Overview how close performance is to goals set out.</td>
<td>VIZ</td>
<td>Spider diagram needs to show passing score, group comparison and current performance.</td>
<td>In v1.0 hard coding of standards for two programs, in v2.0 further development.</td>
</tr>
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</tr>
<tr>
<td>V-Req-11</td>
<td>general</td>
<td>VIZ request Track definition</td>
<td>All users</td>
<td>VIZ request track definition for a particular education</td>
<td>VIZ</td>
<td>Let SM expose education definition. JITVIZ API needs to receive definitions and structure from the SM. This also applies to the navigation and title issue. Dynamic information (info that change regularly) to come from the SM. Static information (e.g. curriculum info) is in a config file per education in VIZ module.</td>
<td>V2.0</td>
</tr>
<tr>
<td>V-Req-12</td>
<td>general</td>
<td>VIZ request assessment</td>
<td>Supervisors</td>
<td>VIZ can request assessments for particular students</td>
<td>VIZ</td>
<td>SM API, when time is implemented, querying with time range and EPA return a list of assessments with a timestamp calculated level. V2.0, we will find out from educational partners if it is relevant to choose a number of students to compare (in addition to seeing all my students)</td>
<td>V2.0</td>
</tr>
<tr>
<td>V-Req-13</td>
<td>general</td>
<td>VIZ request assessment</td>
<td>All users</td>
<td>VIZ can request details for particular assessment</td>
<td>VIZ</td>
<td>SM API (details request based on list returned in V-req-2) Covered! v1.0 if possible, otherwise v2.0</td>
<td>V1.0</td>
</tr>
<tr>
<td>V-Req-14</td>
<td>general</td>
<td>VIZ request history</td>
<td>Supervisors/ Program directors</td>
<td>Request EPA development history of a cohort</td>
<td>VIZ</td>
<td>SM API has concept of different cohorts of the students and supports queries. Covered V-Req-10 v1.0 if possible, otherwise v2.0</td>
<td>V1.0</td>
</tr>
</tbody>
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<tr>
<td>V-Req-15</td>
<td>general</td>
<td>VIZ request comparison</td>
<td>Supervisors/program directors (students?)</td>
<td>Compare a single student to a group</td>
<td>VIZ</td>
<td>Combination of V-Req-2 and V-Req-4</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td>V-Req-16</td>
<td>general</td>
<td>VIZ request comparison type of assessment</td>
<td>students</td>
<td>Show difference in score on assessments according to type (e.g., self-assessment and assessor’s evaluation)</td>
<td>VIZ</td>
<td>Assessments must define type, VIZ differentiates in types and visualize differences. Spider diagram with shape for each assessor category. Not all assessor categories assess all competencies.</td>
<td>V2.0</td>
</tr>
<tr>
<td>V-Req-17</td>
<td>general</td>
<td>System</td>
<td>All users</td>
<td>Platform agnostic</td>
<td>VIZ</td>
<td>VIZ module to be supported on tablet ***JIT accessible on mobile and tablet.</td>
<td>V2.0</td>
</tr>
</tbody>
</table>

**General requirements**

<table>
<thead>
<tr>
<th>GS-Req-1</th>
<th>General (all users)</th>
<th>Personalization</th>
<th>All users</th>
<th>familiar system, which uses recognizable terms and parameters</th>
<th>All components</th>
<th>V1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>GS-Req-2</td>
<td>Specific user</td>
<td>Fair grading</td>
<td>Supervisor</td>
<td>Knowing whether grading is fair and in line with other supervisors’ grading.</td>
<td>All components</td>
<td>Responsibility of educational partners to provide sufficient information to their students</td>
</tr>
</tbody>
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<tr>
<td>GS-Req-3</td>
<td>Specific user</td>
<td>Holistic system</td>
<td>Student</td>
<td>all information about performance and assessment forms to be gathered in the same system.</td>
<td>All compone nts</td>
<td>By investigating users’ needs and continuous interaction with educational partners</td>
<td>V1.0</td>
</tr>
<tr>
<td>GS-Req-4</td>
<td>Specific user</td>
<td>Relevance and usefulness</td>
<td>Student</td>
<td>Personal information that is relevant and useful</td>
<td>JIT, VIZ</td>
<td>By investigating users’ needs and continuous interaction with educational partners</td>
<td>V1.0</td>
</tr>
<tr>
<td>GS-Req-5</td>
<td>Specific user</td>
<td>Bookmark feature</td>
<td>student</td>
<td>save useful feedback.</td>
<td>JIT</td>
<td></td>
<td>OoS</td>
</tr>
<tr>
<td>GS-Req-6</td>
<td>Specific user</td>
<td>Own goals</td>
<td>Student</td>
<td>Possibility to set goals and follow up on these goals.</td>
<td>EPASS</td>
<td>No instruments to set own goals, and curriculum of educational programs is not designed like this</td>
<td>OoS</td>
</tr>
<tr>
<td>GS-Req-7</td>
<td>Specific user</td>
<td>Group performance</td>
<td>Managerial / program directors</td>
<td>track the performance of groups of students.</td>
<td>VIZ</td>
<td>Focus is on trainers and trainees in the first place</td>
<td>OoS</td>
</tr>
<tr>
<td>GS-Req-8</td>
<td>Specific user</td>
<td>Group performance</td>
<td>Managerial / program directors</td>
<td>information that will help me improve the curriculum.</td>
<td>VIZ</td>
<td>Focus is on trainers and trainees in the first place</td>
<td>OoS</td>
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<tr>
<td>GS-Req-9</td>
<td>general</td>
<td>Browsers</td>
<td>All users</td>
<td>JIT and ViZ running at least in IE9 and the most recent versions of chrome, firefox,.... Browsers need to support SVG. Update of browsers-except for IE-will be done automatically by browser.</td>
<td></td>
<td>All components</td>
<td>V1.0</td>
</tr>
<tr>
<td>GS-Req-9</td>
<td>general</td>
<td>Support</td>
<td>All users</td>
<td>Help function with glossary.</td>
<td>Dashboard</td>
<td>Document needs to be written by educational. partners. Mateum can upload document in system.</td>
<td></td>
</tr>
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