# Survey

The purpose of the survey was to evaluate

* Users’ experiences compared to users’ expectations
* What can be done in addition to the existing assistance to enable, support, or even simplify users’ daily documentation of lab work

## Compilation of survey

For the survey different predefined publically questionnaires were verified:

* User Experience Questionnaires (UEQ)
* Customer Satisfaction Survey (CSS)
* System Usability Scale (SUS)

All of these predefined questionnaires are quite superficial and generalizing, without taking into account any characteristics of laboratory notebooks and the specific practices of scientific lab workers.

The number of question was restricted between 30 and 40 plus a small number of additional free-text questions. The expectation was, that the limited time required to answer about 40 questions would increase the acceptance of the test procedure. As the overall number of users is small (< 80), a return rate of 2/3 was estimated to be essential for meaningful results.

A modified SUS extended by ELN specific questions was finally pre-tested and accepted by non-project lab workers using an identical ELN version and implementation (SaaS).

Next step was the evaluation of different online survey tools. Finally, the decision was taken for SoSci Survey (https://www.soscisurvey.de/) due to high security standards and full integrated questionnaire preparation and testing facilities. For an overview of the questions arranged in the online survey tool see Attachment 1

The survey started on 26.04.2015 and finished 7 weeks later on 14.06.2015. Overall, 77 users (26 PIs and 51 normal users) from 18 academic and SME organisations were invited to take part in the survey.

* Reminders were sent out every 7 to 10 days
* after 5 weeks the return rate was still below 50%
* Reminder send out by project lead increased the return rate to ~80%
* 2 users rejected -> no longer members of the project
* Two questionnaires were rejected due to insufficient no of answers (only 2 out of 9 pages were completed)

Only three types of questions were applied - ordinal scaled, selection and free-text questions.

* For ordinal scaled question the grading ranged from “No/I disagree” via “Neutral” to “Yes/I agree” (Scores =1, 2, 3, respectively vice versa for negative (reversed) questions). This schema means that a high score represents always a positive answer
* For answer “NA/Don’t know” the score = -1
* If a question was not answered the score = -9
* For the evaluation “NA/Don’t know” answers were treated as “not answered”
* For selection questions (e.g. Please indicate how often you use the ELN: Rarely, Sometimes, Frequently) the corresponding score is 1, 2, 3 or -9 for not answered questions. The score could be directly linked to the answer. Mean or median values are not appropriate. These type of questions are used to group user answers (see below)
* Free-text questions were grouped by the general implication of the answers

As usual, positive and negative questions were mixed for later improvement of the evaluation based on consistent answers. The survey was evaluated with KNIME version 2.12.0 (Build July 13, 2015). The workflow including data is attached as supplement.

## Results of the survey

Interpretation of the results:

* For getting an impression about the homogeneity of the answer the confidence limit (p=0.05) was calculated based on the standard deviation of the scores and the number of answers given. For a defined confidence limit < 0.225 the answers were assumed to be homogeneous, for all others the answers were inhomogeneous. This confidence limit of 0.225 is based on 25% opposite answers out of 58, the maximum number of answers in this survey per question.
	+ if CL is small and overall score of a question is high, a positive user acceptance can be postulated
	+ If CL is small and overall score is small action should be taken asap
	+ If CL is high a more detailed evaluation e.g. split by frequency of usage or OS was applied to find out if there is a specific constellation which caused the resulting answers

In the end, the return rate of completed surveys was higher than expected and most of the users also added free-text to the appropriate questions.

The time spent on the questionnaire (Table 1) was moderate with a median of about 6 minutes for answering the full questionnaire including free-text answers. Only 7 users spent less than 4 minutes on the questionnaire and even some of them answered free-text questions.

The incidence of OS (Table 2) used was as expected with 37 Windows and 21 UNIX users (Mac OS and Linux). Compared to the Desktop OS Market Share (<https://www.netmarketshare.com/operating-system-market-share.aspx?qprid=10&qpcustomd=0&qpcustomb=> accessed 04.08.2015) the incidence of the UNIX based systems are quite higher while the relative number of Mac OS/Linux is comparable. This may be originated by the huge number of users preparing in silico studies.

Typically, the ELN is used rarely or sometimes (Table 3) with less than 1h per session (53%). Only 9% of users spent more than 1 or 2 h per session on a more frequent basis. Even so, 16% of the users operated the ELN frequently with less than 1h per session. Nobody used the system frequently for more than 2 h. This implies that either most of the users are doing infrequent experimental work or that even users doing frequent work document their work on an irregular basis. This coincidence with the number of experiments created per month (see Figure 2)

Split by OS (Table 4) it is obvious that UNIX users are using the ELN less frequently and for short sessions only in contrast to Windows users. Finally it would have been very interesting how many different combinations of OS, browsers and office version within the consortium were in production, but this information was not queried.

In Table 5 the most frequent answers to the questions are listed together with estimations if the answers are more uniquely or irregularly distributed. The columns in the table are

* Count = number of answers given to the specific question
* Mode = most frequently given answer
* CL = confidence limit calculated on the standard deviation of the scores and the number of answers given
* Uniformity of answer = “uniform” if CL is < 0.225, “inconsistent” if CL >=0.225

The order of the questions is changed compared to the questionnaire (attachment) as here questions with same meaning are grouped together. As mentioned above, some of the questions are asked twice, once in a positive way, next as a reversed question (e.g. “The speed of this software is fast enough” and “This software responds too slowly to inputs”). Some of these pairs of questions were answered contradictory, but in any of these cases (e.g. for both questions “I can understand and act on the information provided by this software” and “I sometimes don't know what to do next with this software”) most users answered with “Yes” for both questions, but for the second question the answers were not as unique as for the first one (see CL)). This inconsistency might be related to some unclear formulation of the questions, but could also be influenced by some “rushing” through the questionnaire which is also supported by some low (25% of users <5 minutes) times spent on the survey (see Table 1).

Due to this fact a more detailed analysis was applied by grouping answers according to OS or frequencies using the ELN. Table 6 groups the results based on the OS used by the operator of the ELN. Positive answers are marked green, negative are marked red, based on the type of question (reversed or not).

Summarized result based on the answers grouped by OS:

* Windows users mainly prepare wet lab work while UNIX user prepare in silico work
* Only Windows users using group templates, maybe group size is larger or groups are doing similar work
* Windows users find the software too slow (two answers) and to labour-intensive
* Windows users know the functionality of the ELN, as they are also using the system more frequently (Table 4)
* Mac and Linux users are more comfortable with the software, but they would not use or recommend this software again (two answers), this may be related to the specific in silico work which might not be supported by the ELN sufficiently
* Linux users feel more controlled than e.g. Mac users – this may be an issue of a single working group

The following Table 7 groups all questions according to the frequency of usage. Again, answers are marked green if the overall result is positive or red if the result is negative, based on the type of question (reversed or not).

Summarized results based on frequency of usage:

* In silico users using the ELN less frequent, which is apparent as computational experiments generally run for a longer period of time than wet lab experiments
* More frequently users operate the ELN online during their lab work
* Frequent users would like to have higher performance (two answers) this might be related to Windows (see Table 4)
* More frequently usage of the ELN increased the quality of the documentation (tendency!)
* Frequent users are not disrupted by documenting their work in the ELN, they like the software and would use an ELN in future
* Frequent users of an ELN realize a positive effect on the way documentation is prepared
* More frequent users like the software and feel lucky about using the software (tendency!) while rarely users find the ELN complex and are frustrated about functionality
* Rarely users are disappointed about searching - this might also be a training effect.

Summarized, based on OS and frequency: Windows users are unhappy about the performance of the system. This may be related to the fact that lab staff often has to use outdated operating systems (XP) running on old hardware. Instruments used in the lab are connected to hardware which was bought together with the instrument. As this special software was developed specifically for this instrument, updates or upgrades to the software frequently are only applied during the first years until a new instrument is on the market. Most vendors do not migrate software to a new version of the OS, particularly, if there are dependencies on other hardware (e.g. interface-cards) and/or specific drivers. Thus, instruments are used for years without support for the newest (and most secure) OS version. A lot of instruments are still running on Windows XP although the official support for this OS is expired. And frequently, lab works run other supportive software like office software and ELNs on these types of systems.

In addition, Windows systems are more frequently manipulated by malware than other systems therefore administrators are more restrictive with user rights. Users are not allowed to install or update software, these out-dated systems are not connected to the internet, which is a prerequisite for a SaaS based solution, or other software (e.g. office packages) could not be updated to a supported version due to the old OS and/or hardware. All of these problems were encountered during the project.

Beside these ordinal scaled questions users were asked for comments based on their experience with the ELN. These free text questions are summarized in Table 8 together with an overall rating on the user feedback. Listed are only user replies with at least one comment.

In general, based on the free text answers, most users (~40%) are not satisfied with the selected ELN solution (Table 9). Only 23% of the users feel comfortable with the system.

A quite interesting answer to the question “What do you think needs most improvement, and why?” is “It require a new way of documentation, this is unusual at Universities” and the same user mentioned that “we need to search how to integrate the ELN into the daily documentation” as suggestions for improvement. This answer shows that there are also other issues which influence the usage of the ELN. Most other users complained to specific functionalities, the user interface or specific personal demands.

As can be seen from the answers the last update was not satisfying. Users adapt very quickly to a GUI and are confused when changes happen. This is a potential problem of the selected SaaS solution. This must be differentiated from general impacts by an ELN. The GUI and the changes to the GUI were questioned by a lot of users. This is, in contrast to the issue mentioned above, a specific problem of the selected ELN and not related to installation as a SaaS solution. Sharing data with other users and storing all data in one location seems to be the most important positive deliverable the ELN introduces to the project, with additional workload for the individual user. This should always be considered introducing an ELN solution for a project.

## Conclusion survey

The main purpose of the survey was to understand the infrequent usage of the ELN and if this is dependent on the selected solution or influenced by other, non ELN related, factors.

Most users found the selected solution not being appropriate for their specific requirements. Either the solution doesn’t support specific data sets or experiment types, or the solution doesn’t respond fast enough to be used adequately. This indicates that the solution was not selected thoroughly. More individual user demands have to be considered. But this definitely needs additional resources in time and manpower than can be admitted in a public funded project. Especially time could be an issue as the work packages normally start experimental work within less than 6 month after the kick-off meeting and the documentation process should begin in parallel to the experimental initiation. Keeping in mind that every user needs some time to get acquainted to a new system and that there are always initial ‘pitfalls’ to any newly introduced system an electronic laboratory notebook must be available within 4-5 month after kick-off having at least few weeks’ time for an initial training of the users (not all users are available at the same time). About another month should be planned for the negotiation process for specific solutions with different vendors. This reduces the time frame for a systematically user requirement evaluation to less than 1 month closely to the kick-off meeting as another month or two are required for writing and launching the tender process. On the other hand, one month after the kick-off meeting not all types of experiments are fully agreed on and not all users are on board. Thus the selection process must be made on some assumptions as was done in the described PPP project.

The slow response of the selected system has quite different causes. It might be related to the bandwidth available at the location, but more frequently this is based on the hardware available. Basic functionality was tested on a slow line (2000 Kbit/s download, 200KBits/s upload) and on a fast speed line (23MBits/s download and 1.1MBits/s upload) both with actual hardware on all operating systems and different browsers. The performance was ok, even on the slow line, but the rendering was clearly dependent on the selected OS/browser combination. What we didn’t test was old hardware. Throughout the last two years of support we realized that even computers with Windows XP, MS Office 2003 and Internet Explorer 8 are used especially in labs. This seems to be one of the bottle necks for the slow response of the ELN solution. Another one could be uploading huge data sets on slow Asymmetric Digital Subscriber Lines (ADSL). Typically, users mainly working on local file servers or only downloading data from the internet facing an unusual slow behaviour when uploading data to a web resource on an ADSL (Asymmetric Digital Subscriber Line), which is due to low upload speed. This is true for all centralized server infrastructure accessed by internet lines including SaaS and should be considered when discussing centralized solution hosting.

Finally, users demand same functionality as they have available on their daily working platform. This is an unsolved challenge as the heterogeneity of software used in life sciences from interactive GUI based office package to high sophisticated batch processing packages is tremendously. In future vendors might find a solution as more and more new ELNs are available on the market.

For the ongoing PPP project a more individualized user support might help to overcome some of the issues mentioned in the survey. An individual on-site training parallel to the experimental work could help understand the issues and give advice for solutions or workarounds. But this requires either additional travel costs for small group of super users or a training budget for a widely spread group of well-trained super users which always need to be informed about all actual issues and solutions.

Summarized results of the survey:

* ELN solution for sharing protocols and results must be carefully introduced and implemented
* There is no one simple solution to fit all different user expectations
* User expectations are quite different. Computer affine users (computational scientists) demand different functionalities than other users
* Wet lab workers require high performance and high accessibility to use the system online
* Sufficient hardware and OS support, especially for lab workers
* More flexibility is demanded by end users



Attachment 1 Questionnaire

|  |  |
| --- | --- |
| Time spent on survey | Minutes |
| Minimum | 2,7 |
| Smallest | 2,7 |
| Lower Quartile | 4,5 |
| Median | 5,7 |
| Upper Quartile | 7,3 |
| Largest | 11,1 |
| Maximum | 12,8 |

Table 1 Time spent on questionnaire

|  |  |  |  |
| --- | --- | --- | --- |
| Which platform do you frequently use to access the ELN? | No of users | Percentage | Desktop Operating System Market Share |
| Mac | 14 | 24% | 5% |
| Windows | 37 | 64% | 90% |
| Linux | 7 | 12% | 2% |

Table 2 Frequency of operating systems (OS)

|  |  |  |  |
| --- | --- | --- | --- |
| Please indicate how often you use the ELN | Please indicate how long you use the ELN during a normal session | No of users | Percentage |
| Rarely | <1h | 14 | 24% |
| Rarely | 1-2h | 5 | 9% |
| Sometimes | <1h | 17 | 29% |
| Sometimes | 1-2h | 8 | 14% |
| Sometimes | >2h | 1 | 2% |
| Frequently | <1h | 9 | 16% |
| Frequently | 1-2h | 4 | 7% |

Table 3 Frequency and Duration of usage of the ELN

| Please indicate how often you use the ELN | Please indicate how long you use the ELN during a normal session | Which platform do you frequently use to access the ELN? | No of users | Percentage | Percentage/OS |
| --- | --- | --- | --- | --- | --- |
| Rarely | <1h | Linux | 2 | 3% | 29% |
| Sometimes | <1h | Linux | 5 | 9% | 71% |
| Rarely | <1h | Mac | 3 | 5% | 21% |
| Rarely | 1-2h | Mac | 4 | 7% | 29% |
| Sometimes | <1h | Mac | 5 | 9% | 36% |
| Frequently | <1h | Mac | 2 | 3% | 14% |
| Rarely | <1h | Windows | 9 | 16% | 24% |
| Rarely | 1-2h | Windows | 1 | 2% | 3% |
| Sometimes | <1h | Windows | 7 | 12% | 19% |
| Sometimes | 1-2h | Windows | 8 | 14% | 22% |
| Sometimes | >2h | Windows | 1 | 2% | 3% |
| Frequently | <1h | Windows | 7 | 12% | 19% |
| Frequently | 1-2h | Windows | 4 | 7% | 11% |

Table 4 Frequency and Duration of usage per OS

| Count | Mode | CL | Question | Answer | Uniformity of answer |
| --- | --- | --- | --- | --- | --- |
| 58 | 1 | 0,160 | I never used an ELN before the TRANSLOCATION project (reversed) | Yes/ agree | uniform |
| 55 | 3 | 0,249 | I prepare wet lab work | Yes/ agree | inconsistent |
| 53 | 3 | 0,258 | I prepare in-silico work | Yes/ agree | inconsistent |
| 51 | 1 | 0,172 | I use the chemical structure option | No/ disagree | uniform |
| 57 | 1 | 0,180 | I use a paper lab book in addition to the ELN (reversed) | Yes/ agree | uniform |
| 56 | 1 | 0,225 | I use the ELN online during my lab work | No/ disagree | uniform |
| 48 | 1 | 0,257 | Our group uses group templates | No/ disagree | inconsistent |
| 54 | 3 | 0,241 | I'm using personal templates for my experiments | Yes/ agree | inconsistent |
| 53 | 3 | 0,222 | The speed of this software is fast enough | Yes/ agree | uniform |
| 51 | 2 | 0,223 | This software responds too slowly to inputs (reversed) | Neutral | uniform |
| 52 | 2 | 0,211 | The ELN helps me in understanding the results from other co-workers | Neutral | uniform |
| 40 | 1 | 0,181 | The ELN has increased group productivity | No/ disagree | uniform |
| 53 | 1 | 0,228 | The ELN increased the quality of documentation | No/ disagree | inconsistent |
| 51 | 1 | 0,225 | The ELN has freed up some time | No/ disagree | inconsistent |
| 51 | 3 | 0,214 | The ELN has decreased my personal productivity (reversed) | No/ disagree | uniform |
| 53 | 1 | 0,227 | I would recommend this software to my colleagues | No/ disagree | inconsistent |
| 50 | 1 | 0,248 | If I could decide, I would NOT use an ELN again (reversed) | Yes/ agree | inconsistent |
| 52 | 1 | 0,222 | The way I'm documenting my lab work has positively changed using an ELN | No/ disagree | uniform |
| 52 | 1 | 0,228 | This software seems to disrupt the way I normally like to arrange my work (reversed) | Yes/ agree | inconsistent |
| 56 | 2 | 0,208 | The ELN is easy to use | Neutral | uniform |
| 49 | 1 | 0,235 | I sometimes wonder if I am using the right function (reversed) | Yes/ agree | inconsistent |
| 42 | 2 | 0,206 | It is obvious that user needs have been fully taken into consideration | Neutral | uniform |
| 55 | 3 | 0,216 | The ELN is too complex to be used sufficiently (reversed) | No/ disagree | uniform |
| 51 | 3 | 0,235 | The user interface of the ELN is simple enough to be used online in the lab | Yes/ agree | inconsistent |
| 53 | 1 | 0,220 | The software hasn't always done what I was expecting (reversed) | Yes/ agree | uniform |
| 54 | 3 | 0,198 | I can understand and act on the information provided by this software | Yes/ agree | uniform |
| 52 | 1 | 0,231 | I sometimes don't know what to do next with this software (reversed) | Yes/ agree | inconsistent |
| 52 | 3 | 0,173 | The organisation of the menus seems quite logical | Yes/ agree | uniform |
| 51 | 3 | 0,233 | There are too many steps required to get something to work (reversed) | No/ disagree | inconsistent |
| 55 | 2 | 0,193 | Tasks can be performed in a straight forward manner using this software | Neutral | uniform |
| 51 | 3 | 0,222 | I will never learn to use all that is offered in this software (reversed) | No/ disagree | uniform |
| 46 | 3 | 0,216 | I have got sufficient support by my supervisor for working with the ELN | Yes/ agree | uniform |
| 53 | 3 | 0,193 | I don't know what to record in the ELN (reversed) | No/ disagree | uniform |
| 37 | 3 | 0,246 | The helpdesk support is satisfying | Yes/ agree | inconsistent |
| 43 | 3 | 0,210 | The training on the ELN was NOT adequate (reversed) | No/ disagree | uniform |
| 51 | 2 | 0,215 | Searching of information is straight forward within the ELN | Neutral | uniform |
| 48 | 3 | 0,185 | I never find information I'm searching in the ELN (reversed) | No/ disagree | uniform |
| 47 | 2 | 0,227 | I feel the ELN will be used to control my lab work (reversed) | Neutral | uniform |
| 53 | 3 | 0,179 | I use the ELN for controlling the work of my staff/colleagues (reversed) | No/ disagree | uniform |

Table 5 Answers most frequently given to the questions incl. uniformity of answers

| Question | Mac users | Windows users | Linux users |
| --- | --- | --- | --- |
| I never used an ELN before the TRANSLOCATION project (reversed) | Yes/ agree | Yes/ agree | Yes/ agree |
| I prepare wet lab work | No/ disagree | Yes/ agree | No/ disagree |
| I prepare in-silico work | Yes/ agree | No/ disagree | Yes/ agree |
| I use the chemical structure option | No/ disagree | No/ disagree | No/ disagree |
| I use a paper lab book in addition to the ELN (reversed) | Yes/ agree | Yes/ agree | Yes/ agree |
| I use the ELN online during my lab work | No/ disagree | No/ disagree | No/ disagree |
| Our group uses group templates | No/ disagree | Yes/ agree | No/ disagree |
| I'm using personal templates for my experiments | Yes/ agree | Yes/ agree | Yes/ agree |
| The speed of this software is fast enough | Yes/ agree | No/ disagree | Yes/ agree |
| This software responds too slowly to inputs (reversed) | No/ disagree | Yes/ agree | No/ disagree |
| The ELN helps me in understanding the results from other co-workers | Yes/ agree | Neutral | Neutral |
| The ELN has increased group productivity | No/ disagree | No/ disagree | No/ disagree |
| The ELN increased the quality of documentation | No/ disagree | No/ disagree | Yes/ agree |
| The ELN has freed up some time | No/ disagree | No/ disagree | No/ disagree |
| The ELN has decreased my personal productivity (reversed) | No/ disagree | No/ disagree | No/ disagree |
| I would recommend this software to my colleagues | No/ disagree | Neutral | No/ disagree |
| If I could decide, I would NOT use an ELN again (reversed) | Yes/ agree | No/ disagree | Yes/ agree |
| The way I'm documenting my lab work has positively changed using an ELN | No/ disagree | No/ disagree | Neutral |
| This software seems to disrupt the way I normally like to arrange my work (reversed) | Yes/ agree | Yes/ agree | Neutral |
| The ELN is easy to use | Neutral | Yes/ agree | Yes/ agree |
| I sometimes wonder if I am using the right function (reversed) | No/ disagree | Yes/ agree | No/ disagree |
| It is obvious that user needs have been fully taken into consideration | Neutral | Neutral | Yes/ agree |
| The ELN is too complex to be used sufficiently (reversed) | No/ disagree | No/ disagree | Neutral |
| The user interface of the ELN is simple enough to be used online in the lab | Yes/ agree | Yes/ agree | Yes/ agree |
| The software hasn't always done what I was expecting (reversed) | Neutral | Yes/ agree | No/ disagree |
| I can understand and act on the information provided by this software | Yes/ agree | Yes/ agree | Yes/ agree |
| I sometimes don't know what to do next with this software (reversed) | No/ disagree | Yes/ agree | Yes/ agree |
| The organisation of the menus seems quite logical | Neutral | Neutral | Yes/ agree |
| There are too many steps required to get something to work (reversed) | No/ disagree | Yes/ agree | Neutral |
| Tasks can be performed in a straight forward manner using this software | Neutral | Neutral | Yes/ agree |
| I will never learn to use all that is offered in this software (reversed) | Neutral | No/ disagree | Neutral |
| I have got sufficient support by my supervisor for working with the ELN | Yes/ agree | Yes/ agree | Yes/ agree |
| I don't know what to record in the ELN (reversed) | No/ disagree | No/ disagree | Neutral |
| The helpdesk support is satisfying | Yes/ agree | Yes/ agree | Yes/ agree |
| The training on the ELN was NOT adequate (reversed) | No/ disagree | No/ disagree | No/ disagree |
| Searching of information is straight forward within the ELN | Neutral | Neutral | Neutral |
| I never find information I'm searching in the ELN (reversed) | No/ disagree | No/ disagree | Neutral |
| I feel the ELN will be used to control my lab work (reversed) | No/ disagree | Neutral | Yes/ agree |
| I use the ELN for controlling the work of my staff/colleagues (reversed) | No/ disagree | No/ disagree | No/ disagree |
| Positive answered questions | 10 | 6 | 10 |
| Negative answered questions | 2 | 6 | 4 |

Table 6 Answers grouped by OS; questions answered similar by all OS users are greyed

| Question | Rarely | Sometimes | Frequent |
| --- | --- | --- | --- |
| I never used an ELN before the TRANSLOCATION project (reversed) | Yes/ agree | Yes/ agree | Yes/ agree |
| I prepare wet lab work | Yes/ agree | Yes/ agree | Yes/ agree |
| I prepare in-silico work | Yes/ agree | Yes/ agree | No/ disagree |
| I use the chemical structure option | No/ disagree | No/ disagree | No/ disagree |
| I use a paper lab book in addition to the ELN (reversed) | Yes/ agree | Yes/ agree | Yes/ agree |
| I use the ELN online during my lab work | No/ disagree | No/ disagree | Yes/ agree |
| Our group uses group templates | No/ disagree | No/ disagree | No/ disagree |
| I'm using personal templates for my experiments | Yes/ agree | Yes/ agree | Yes/ agree |
| The speed of this software is fast enough | Yes/ agree | Yes/ agree | No/ disagree |
| This software responds too slowly to inputs (reversed) | Neutral | Yes/ agree | Yes/ agree |
| The ELN helps me in understanding the results from other co-workers | No/ disagree | Neutral | Neutral |
| The ELN has increased group productivity | No/ disagree | No/ disagree | Neutral |
| The ELN increased the quality of documentation | No/ disagree | Neutral | Yes/ agree |
| The ELN has freed up some time | No/ disagree | No/ disagree | No/ disagree |
| The ELN has decreased my personal productivity (reversed) | Neutral | No/ disagree | No/ disagree |
| I would recommend this software to my colleagues | No/ disagree | Yes/ agree | Yes/ agree |
| If I could decide, I would NOT use an ELN again (reversed) | Yes/ agree | No/ disagree | No/ disagree |
| The way I'm documenting my lab work has positively changed using an ELN | No/ disagree | No/ disagree | Yes/ agree |
| This software seems to disrupt the way I normally like to arrange my work (reversed) | Yes/ agree | No/ disagree | No/ disagree |
| The ELN is easy to use | Neutral | Yes/ agree | Yes/ agree |
| I sometimes wonder if I am using the right function (reversed) | Yes/ agree | No/ disagree | No/ disagree |
| It is obvious that user needs have been fully taken into consideration | Neutral | Neutral | Neutral |
| The ELN is too complex to be used sufficiently (reversed) | Yes/ agree | No/ disagree | No/ disagree |
| The user interface of the ELN is simple enough to be used online in the lab | No/ disagree | Yes/ agree | Neutral |
| The software hasn't always done what I was expecting (reversed) | Yes/ agree | No/ disagree | Yes/ agree |
| I can understand and act on the information provided by this software | Neutral | Yes/ agree | Yes/ agree |
| I sometimes don't know what to do next with this software (reversed) | Yes/ agree | No/ disagree | No/ disagree |
| The organisation of the menus seems quite logical | Neutral | Yes/ agree | Neutral |
| There are too many steps required to get something to work (reversed) | Yes/ agree | No/ disagree | No/ disagree |
| Tasks can be performed in a straight forward manner using this software | Neutral | Neutral | Yes/ agree |
| I will never learn to use all that is offered in this software (reversed) | Yes/ agree | Neutral | No/ disagree |
| I have got sufficient support by my supervisor for working with the ELN | Yes/ agree | Yes/ agree | Yes/ agree |
| I don't know what to record in the ELN (reversed) | No/ disagree | No/ disagree | No/ disagree |
| The helpdesk support is satisfying | Yes/ agree | Yes/ agree | Yes/ agree |
| The training on the ELN was NOT adequate (reversed) | No/ disagree | No/ disagree | No/ disagree |
| Searching of information is straight forward within the ELN | No/ disagree | Neutral | Neutral |
| I never find information I'm searching in the ELN (reversed) | Neutral | No/ disagree | No/ disagree |
| I feel the ELN will be used to control my lab work (reversed) | No/ disagree | Yes/ agree | Neutral |
| I use the ELN for controlling the work of my staff/colleagues (reversed) | No/ disagree | No/ disagree | No/ disagree |
| Positive answered questions | 3 | 16 | 16 |
| Negative answered questions | 16 | 5 | 4 |

Table 7 Answers grouped by frequency of ELN usage; questions answered similar by all users are greyed

| What do you think is the best aspect of this software, and why? | What do you think needs most improvement, and why? | Do you have any other suggestions? | User Experience |
| --- | --- | --- | --- |
| Automatically stay updated on colleagues' progress. | Every second I spend clicking buttons and finding my way around different features is a second I could spend doing something more productive. I just need something simple and straight forward to type into, like Notepad. Also, it's quite obvious that this software is more geared towards the experimental crowd. |  | bad |
| there is no good aspect | speed, GUI, accessibility ... in 2015, this software is kind of a no-go ... it feels like being back into the 90s, where you have your first Windows installation and the sandclock turning around and you keep waiting and waiting and waiting until something happens .. haven't seen such a bad program in years | ever heart of drag-and-drop recently? ... Safari compatibility is bad ... many lab-computers do not have admin rights; so installing new plugins is of course problematic ... the Microsoft plugin is very bad ... and so on... | bad |
|  | There must be functionality to to do copy paste directly from other documents. Retyping takes too much time as the documents we make includes lots of special characters. |  | need improvement |
|  | Hard to find data in input from other labs. |  | need improvement |
| Classification of information for sharing | Ease of use, number of steps |  | need improvement |
|  | improve the comfort , make easier |  | need improvement |
| Easy to use and fast input response. | The privileges for reading and modifying the experiments should be more clearly discernible by the user and, if possible, the user should be able to manage this aspect for its own documents. |  | need improvement |
| Keep record of experiments in a readable manner, requires that user makes some effort to present data in a comprehensible fashion, safe storage of information | more user friendly |  | need improvement |
| Traceability | Use |  | need improvement |
| To share results with other groups | Overview of the content of documented results with respect to topics  | No | need improvement |
| None | Speed |  | need improvement |
|  | Encouraging people to fill in.Better interface that will show everything that you loaded in your experiment, for example not only the first pages of a pdf. |  | need improvement |
| Easy to handle, can be accessed from any part of this world, documentation can be preserved and is transparent | pictorial representations and other sophisticated tools | Not really | need improvement |
|  | ELN is not geared to our sort of data generation. A useful ELN would allow access to original raw data linking various aspects of interpretation to the actual raw data. At the moment it is not very productive copy and paste of processed data. | An ELN needs to be designed with the requirements of the users in mind or be flexible enough to allow working with the individual data formats of the research groups (In our case LC-MS data). We tried to find a suitable system in other projects but were not very successful (or the providing companies inflexible). | need improvement |
|  | Speed |  | need improvement |
| Online documentation of the work | Organizing folders by user which is not included | I think it would be nice if one can organize their data in respective folder it is highly confusing to retrieve the data | need improvement |
| The best aspect of ELN is that the data are on-line available | The handling of ELN is often cumbersome | The handling of ELN should be improved | need improvement |
| nothing, just annoying | it doubles the workload of documentation. the network performance is way too low |  | need improvement |
|  | File uploading process should be improved. Option for copying text should be available.  | The interface can be improved by including some frequently used commands like degree centigrade etc.. rather than making many categories, I think frequently used commands and options should be kept in open.  | need improvement |
| My data are always available, anywhere where I have access to a computer. I have my office and my lab in different buildings, so for me the ELN is better than carrying around a paper lab book. | It would be great to have the possible to make sub-folders in my profile (similar to the folders on my computer). |  | need improvement |
| The transparency in the group work and data/results, or between different groups, is a really good feature | I think the project-folder organization, lost with the last update, should be regained. |  | need improvement |
| The best aspect is, that I can access my data files from anywhere, I don't need to carry all my data with me, I can just open my account and every experiment I did is right there | if there could be an option that with whom I want to share the experiment. I think it would be nice if we had a option to make a specific experiment visible to some specific people.  |  | need improvement |
| Easy to use interface is quite nice | Speed and user control |  | need improvement |
| About ELN in general: importing plots, data etc from other software. | Response time to notebook updates are sluggish, at best (before the recent ELN update, I had no problems).  | Column headers can't be resized (before it was possible). Although the search function has been greatly improved, I miss the possibility of having my experiments grouped by year, and also sorting them by crating date. | need improvement |
| In a group only if everybody use it that's a good instruments, because we can check the work of other people | Because I am from a simulations group we have large images that sometimes are difficult to insert and visualize | No | ok |
| The ease of use and the appearance are pleasing in addition to the numerous options available to choose from for the right work.  | The ease of revoking a submitted document before countersign could help if any such document was submitted by mistake or need some revision.  | NA | ok |
|  |  | The last update makes the organisation of the ELN more complex. | ok |
|  | do not know | no | ok |
| I allows to track what each worker is doing in the working time | Writing down each experiment, arranging pictures and figures takes too much time. In my opinion keeping a well done electronic lab book takes simply too much time, time that you are no using to do research. | Maybe the design of specific hardware could make it easier. Something like a personal tablet where you can take pictures, edit then in a fast way and upload the results in the electronic book. | ok |
| can present the work in most concise way, helpful in a network of researchers to know about everybody's work. | can't think any. | no | good |
| Record | none | No | good |
| I think that for lab work it is easy to trace the ongoing experiments. Additionally, I think that it is very useful to have a common procedure to save the information. probably, for some researches (theory, for example) it is not as important as for experimental groups. |  |  | good |
| Structured documentation and search function | It require a new way of documentation, this is unusual at Universities  | we need to search how to integrate the ELN into the daily documentation | good |
| Easy sharing of information  |  |  | good |
| easy to use |  |  | good |
| to centralize data |  | no | good |
| Easy to handle | nothing | no | good |

Table 8 Free text answers categorized to “generally bad”, “software needs some improvements”, “ok”, “good”; 21 users didn’t add any free text

|  |  |  |
| --- | --- | --- |
| User Experience | No | Percentage |
| Bad | 2 | 3% |
| Need Improvement | 22 | 38% |
| Not answered | 21 | 36% |
| Ok | 5 | 9% |
| Good | 8 | 14% |

Table 9 Summarized user experience based on free text answers

Table 10: Overview of all questions from survey with both numbers and relative figures regarding given answer.

|  | **NA/ Don't know** |  | **Neutral** |  | **No/ disagree** |  | **Yes/ agree** |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** |
| Part1: I don't know what to record in the ELN (reversed) | 5 | 9% | 7 | 12% | 39 | 67% | 7 | 12% |
| Part1: I never used an ELN before the TRANSLOCATION project (reversed) |  | 0% | 1 | 2% | 6 | 10% | 51 | 88% |
| Part1: I prepare in-silico work | 5 | 9% | 5 | 9% | 23 | 40% | 25 | 43% |
| Part1: I prepare wet lab work | 3 | 5% | 1 | 2% | 18 | 31% | 36 | 62% |
| Part1: I use a paper lab book in addition to the ELN (reversed) | 1 | 2% | 6 | 10% | 7 | 12% | 44 | 76% |
| Part1: I use the chemical structure option | 7 | 12% | 3 | 5% | 43 | 74% | 5 | 9% |
| Part1: I use the ELN online during my lab work | 2 | 3% | 9 | 16% | 33 | 57% | 14 | 24% |
| Part1: I'm using personal templates for my experiments | 4 | 7% | 6 | 10% | 16 | 28% | 32 | 55% |
| Part1: Our group uses group templates | 10 | 17% | 8 | 14% | 24 | 41% | 16 | 28% |
| Part2: I can understand and act on the information provided by this software | 4 | 7% | 14 | 24% | 8 | 14% | 32 | 55% |
| Part2: I will never learn to use all that is offered in this software (reversed) | 7 | 12% | 16 | 28% | 23 | 40% | 12 | 21% |
| Part2: Tasks can be performed in a straight forward manner using this software | 3 | 5% | 26 | 45% | 16 | 28% | 13 | 22% |
| Part2: The ELN is too complex to be used sufficiently (reversed) | 3 | 5% | 17 | 29% | 24 | 41% | 14 | 24% |
| Part2: The training on the ELN was NOT adequate (reversed) | 15 | 26% | 11 | 19% | 27 | 47% | 5 | 9% |
| Part2: The user interface of the ELN is simple enough to be used online in the lab | 7 | 12% | 12 | 21% | 14 | 24% | 25 | 43% |
| Part3: I have got sufficient support by my supervisor for working with the ELN | 12 | 21% | 13 | 22% | 7 | 12% | 26 | 45% |
| Part3: I sometimes don't know what to do next with this software (reversed) | 6 | 10% | 15 | 26% | 17 | 29% | 20 | 34% |
| Part3: Searching of information is straight forward within the ELN | 7 | 12% | 20 | 34% | 14 | 24% | 17 | 29% |
| Part3: The helpdesk support is satisfying | 21 | 36% | 10 | 17% | 6 | 10% | 21 | 36% |
| Part3: The way I'm documenting my lab work has positively changed using an ELN | 6 | 10% | 16 | 28% | 23 | 40% | 13 | 22% |
| Part3: There are too many steps required to get something to work (reversed) | 7 | 12% | 15 | 26% | 19 | 33% | 17 | 29% |
| Part4: I never find information I'm searching in the ELN (reversed) | 10 | 17% | 16 | 28% | 28 | 48% | 4 | 7% |
| Part4: I sometimes wonder if I am using the right function (reversed) | 9 | 16% | 15 | 26% | 16 | 28% | 18 | 31% |
| Part4: The ELN has increased group productivity | 18 | 31% | 11 | 19% | 27 | 47% | 2 | 3% |
| Part4: The organisation of the menus seems quite logical | 6 | 10% | 22 | 38% | 4 | 7% | 26 | 45% |
| Part4: The software hasn't always done what I was expecting (reversed) | 5 | 9% | 18 | 31% | 16 | 28% | 19 | 33% |
| Part4: The speed of this software is fast enough | 5 | 9% | 17 | 29% | 15 | 26% | 21 | 36% |
| Part5: I feel the ELN will be used to control my lab work (reversed) | 11 | 19% | 18 | 31% | 14 | 24% | 15 | 26% |
| Part5: I would recommend this software to my colleagues | 5 | 9% | 16 | 28% | 19 | 33% | 18 | 31% |
| Part5: It is obvious that user needs have been fully taken into consideration | 16 | 28% | 21 | 36% | 6 | 10% | 15 | 26% |
| Part5: The ELN has freed up some time | 7 | 12% | 11 | 19% | 29 | 50% | 11 | 19% |
| Part5: The ELN increased the quality of documentation | 5 | 9% | 15 | 26% | 22 | 38% | 16 | 28% |
| Part5: This software responds too slowly to inputs (reversed) | 7 | 12% | 18 | 31% | 16 | 28% | 17 | 29% |
| Part6: I use the ELN for controlling the work of my staff/colleagues (reversed) | 5 | 9% | 12 | 21% | 36 | 62% | 5 | 9% |
| Part6: If I could decide, I would NOT use an ELN again (reversed) | 8 | 14% | 10 | 17% | 17 | 29% | 23 | 40% |
| Part6: The ELN has decreased my personal productivity (reversed) | 7 | 12% | 12 | 21% | 30 | 52% | 9 | 16% |
| Part6: The ELN helps me in understanding the results from other co-workers | 6 | 10% | 21 | 36% | 17 | 29% | 14 | 24% |
| Part6: The ELN is easy to use | 2 | 3% | 21 | 36% | 15 | 26% | 20 | 34% |
| Part6: This software seems to disrupt the way I normally like to arrange my work (reversed) | 6 | 10% | 16 | 28% | 17 | 29% | 19 | 33% |