Optimal

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Optimized Training - Innovative Methods and tools for Acceptance of prior Learning in qualifications and workplace training

Output 9: Pilot testing the implementation of learning materials, methods and tools for recognition of prior learning in courses in partner countries

"Testing, evaluation and validation of pilot courses applying recognition of prior learning"

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Executive summary

The Guri Kunna Upper Secondary School in mid Norway first developed the 'Recognition of Prior Learning' (RPL) to improve class-room pedagogy for large groups of mature learners from industry with a range of experience. The benefits of RPL, supported by Response Technology (RT) pioneered in Norway, were subsequently shared with Scottish partners

The Socrative RT system selected in Scotland was used to support the delivery of multiple-choice questions as part of an RPL/APL process, piloted within the Aquaculture Modern Apprenticeship (MA). Gurri Kunna applied the One2ActEval RT to the delivery of their classroom-based program. Both VET providers were working with the same target audience, mature experienced learners from industry, albeit within very different VET delivery systems.

The evaluation undertaken by learners (see Output 8) and staff and Optimal partners (section 1.1) led to a series of conclusions and proposed actions for improvement by each Optimal VET provider (section 1). Some were specific to the RPL/APL process, whilst others addressed and aligned related aspects of the VET delivery system and pedagogy, within which RPL/APL was a central component.

In summary, the Optimal pilots in Scotland revealed the limitations of RT for work based RPL and APL leading to the conclusion that it should be replaced by a VLE/e-portfolio system for the next phase of development. The Scottish Associated Partner (Inverness College) are subsequently building on the Optimal pilot by applying the resources and pedagogy within a VLE system adopted by the University of the Highlands and Islands (UHI)collective, to which they belong.

Conversely, the One2 Act system was proven to be consistently effective in supporting the classroom-based use of RPL within a classroom pedagogy applied to the delivery of Guri Kunna's aquaculture course to mature learners. However, in the final analysis, as well as the further specifications for improvements (chapter 2.2) to their Response Technology (2nd generation) and its application, Guri Kunna are proposing to unitise their curriculum and add online learning to their delivery. This will lead to better support to learners between classes helping them to consolidate their learning. This will be particularly valuable to the less experienced learners who need more study time, and could lead to time and cost savings for Guri Kunna and their local industry during the aftermath of the Optimal project.

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1. Optimal partners pilot evaluations and conclusions

Each VET partner involved in Optimal (Guri Kunna – mid Norway) and Inverness College (Scotland) evaluated their progress with the implementation of RPL and APL (in the case of Scotland) throughout the Optimal project, helped by informal and formal learner feedback. (See Output 8)

The lessons learnt were shared and discussed at the final partners meeting, which included Teachers Union Ireland (TUI) and their academic expert in pedagogy and RPL. The partners evaluation took full account of the feedback from VET providers (teaching staff) and PLI, who supported Inverness College in Scotland. This has provided an overview from the teaching staff and Optimal partners perspective, culminating in conclusions and recommendations. Some are country and/or delivery mode specific, whilst others refer to the potential for the further development and potential convergence of pedagogies and resources piloted in each country. The future potential of 'blended learning', with RPL and APL at the centre, supported by the most appropriate communication and learning technologies, is considered from the perspective of both countries and the common ground highlighted.

1.1 Staff feedback

1.1.1 Inverness College (Scotland)

The staff were generally enthusiastic about the application of multiple choice delivered via Response Technology (RT) due to a previous positive experience of multiple-choice applications. They appreciated the staff development in the operation of Socrative and were soon able to use the system with learners, draw down results and send them to PLI for analysis.

There were debates with PLI about the appropriateness of some multiple-choice questions for the husbandry level, as they do not extend beyond the MA knowledge requirement as prescribed in the MA Units. However, it was agreed that some knowledge statements are too widely scoped and leave a lot of leeway for different interpretations by different teachers. (This weakness is revealed in more detail in Output report 6 -section 2)

As a result of their Optimal experience, Inverness College plan to incorporate both the multiple-choice questions for RPL and APL and learning episodes within their new on-line VLE and e-portfolio platform under development and to be piloted in 2020.

a) Technology

Socrative describes itself as a 'classroom app for fun, effective engagement and on-the-fly assessments.' It can be used either in the classroom or with learners who are learning remotely. It works on computers, laptops, tablets and phones. Interestingly, 12 out of 13 learners in one group used a mobile phone, 1 used a computer, 12 out of 13 had access to broadband and one 1 used 4G with their mobile phone. There were no technical hitches.

The major concern Inverness College staff had with the Socrative quiz was the use of the question type with multi-correct responses. In such a question, the software allows as many selections as there are correct answers. So, if there are 3 correct answers out of 5 options then only 3 options can be selected rather than the usual situation where you can select as many as you believe to be correct (i.e. potentially all of them but get penalised for incorrect selections).

This meant that what would normally be a much more challenging question type, became a potential weakness if the candidates caught on to it. Two questions where all options were correct were used at the start of the quiz to 'put them off the scent'. Also, candidates were not allowed to go backwards and forwards through the quiz and change their selections. From the results and comments, only one learner realised this weakness.

The Inverness teachers noted the following points to acknowledge if ever using Socrative in the future:

I. The Multiple-Choice questions should only be used for questions where they are asked to select a specific number of answers e.g. 'Select ONE' or 'Select TWO' etc.
II. The mark for each question should be indicated (This had been neglected by PLI)

b) Level of multiple-choice questions

In general learners felt that questions were not too hard or too easy. However, one question was not answered correctly by any of the candidates. It was a multi-answer question that many got partially correct responses. This was a concern to the Inverness College staff.

They believed that this question may need to be examined to find out whether;

- it is a poorly written question,
- a question no one needs to know the answer to, or
- has identified a significant gap in knowledge/understanding.

Inverness College acknowledged that the analysis of responses from all questions was a vital part of quality assurance and continuous improvement. All VET providers are advised to incorporate a rigorous formal evaluation when using multiple choice questions to support APL. Consequently, the responses from a batch of Fish Nutrition and Growth questions were evaluated.

The Moodle VLE's consideration of the 'Facility Index' (the percentage of learners who got the question correct) was applied to the analysis of the questions undertaken by 13 learners results from the main group

Based on this analysis: 9 of the 14 questions appear to be about right, 2 of the 14 are moderately difficult, 1 of the 14 is difficult, 1 of the 14 is extremely easy and 1 of the 14 is either extremely difficult or something is wrong with the question.

This is a typical spread of results from the 'Facility Index' analysis and does not necessarily demonstrate a problem. However, there could be an issue with one or two of the questions and they will be reviewed by the Inverness teachers as they prepare their future VLE/e-portfolio system for 2020.

Overall, the Inverness teachers found the Optimal experience to be beneficial to their learners and themselves as practitioners. The project can at a good time for them and has provided them RPL experience and access to valuable multiple choice question banks mapped to discrete learning episodes that they can adopt within their VLE/e-portfolio system in 2020.

1.1.2 Guri-Kunna (Norway)

The aquaculture VET schools in Norway face challenges related to recruiting teachers with experience from farming industry. From the BlueEDU (2016-2019) project it is known that:

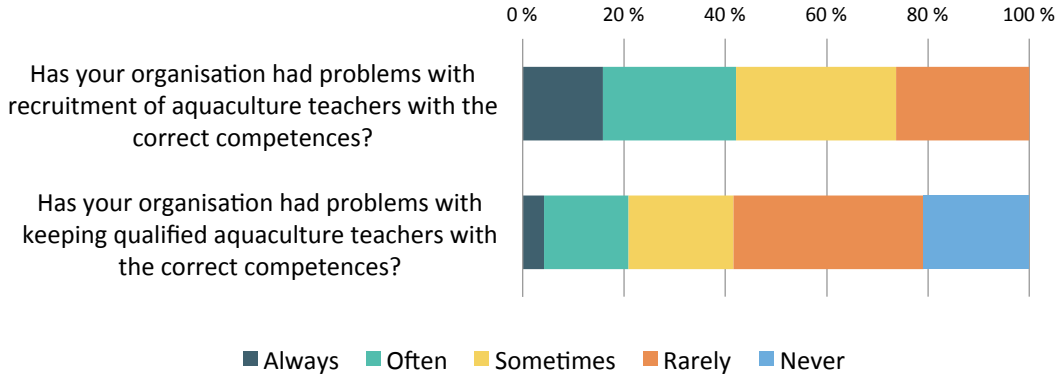

Figure above: How easy is it to recruit and keep qualified teachers?

40% of the teachers pointed out that they always or often had problems in recruiting aquaculture teachers with the correct competence. The later includes practice from fish farming companies. However, when the teachers get engaged and start on their work, less than 30% of the teachers mention that it is difficult to keep the teachers. Nearly 6 out of 10 teachers point out that the aquaculture VET schools keep their aquaculture competence.

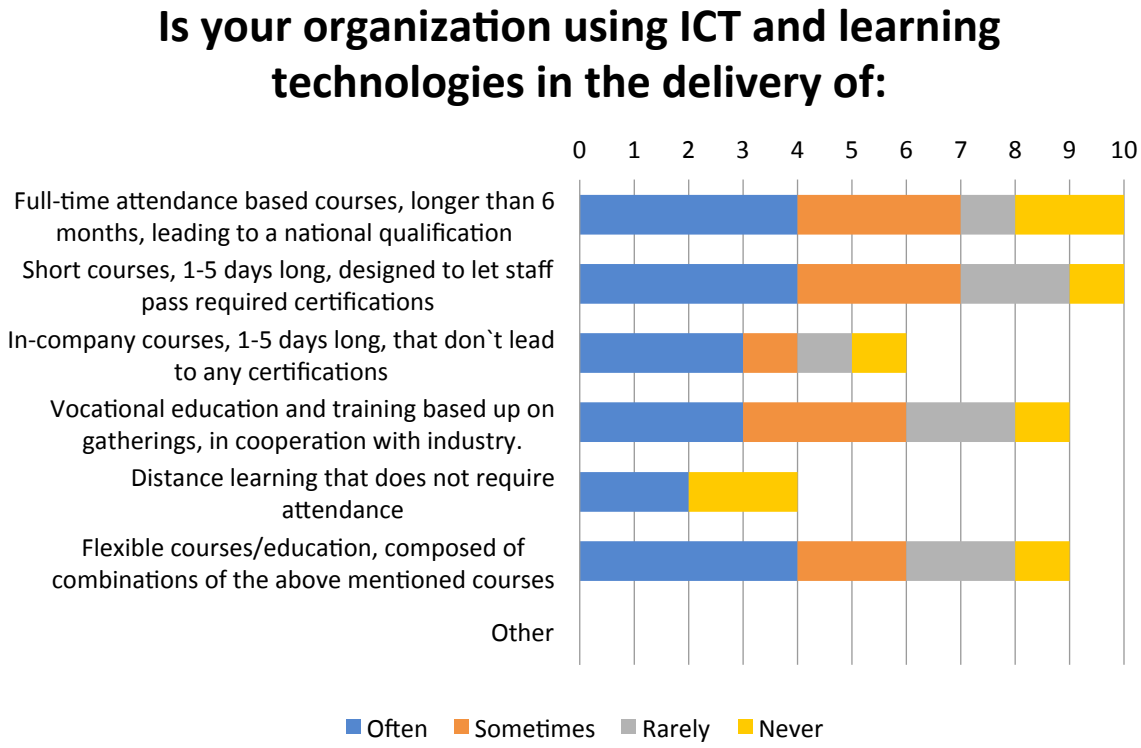

Figure above: How do the aquaculture VET schools apply ICT?

Approximately one third of the teachers were involved in courses applying ICT and learning technologies in their various training activities. At the same time, almost one third of them were not involved in courses applying these technologies, while one third use them sometimes. This shows that teacher-training programs are needed in order to better utilize and deploy ICT in training within the aquaculture sector.

Distance learning was not used frequently. It should be noticed that the majority of the teachers don't reply anything to this question, indicating that they don't know what to answer for this question.

The BlueEDU results showed that approximately 50% of the aquaculture schools offer VET programs to industry. The major method for delivery of training to staff from industry in Norway was and still is, based up on on-site training where students attend gatherings. Only one teacher interviewed by the BlueEDU project included distance learning into the training, despite that fish farming industry in Norway request if e-learning and distance learning may be utilized more in training of their staff.

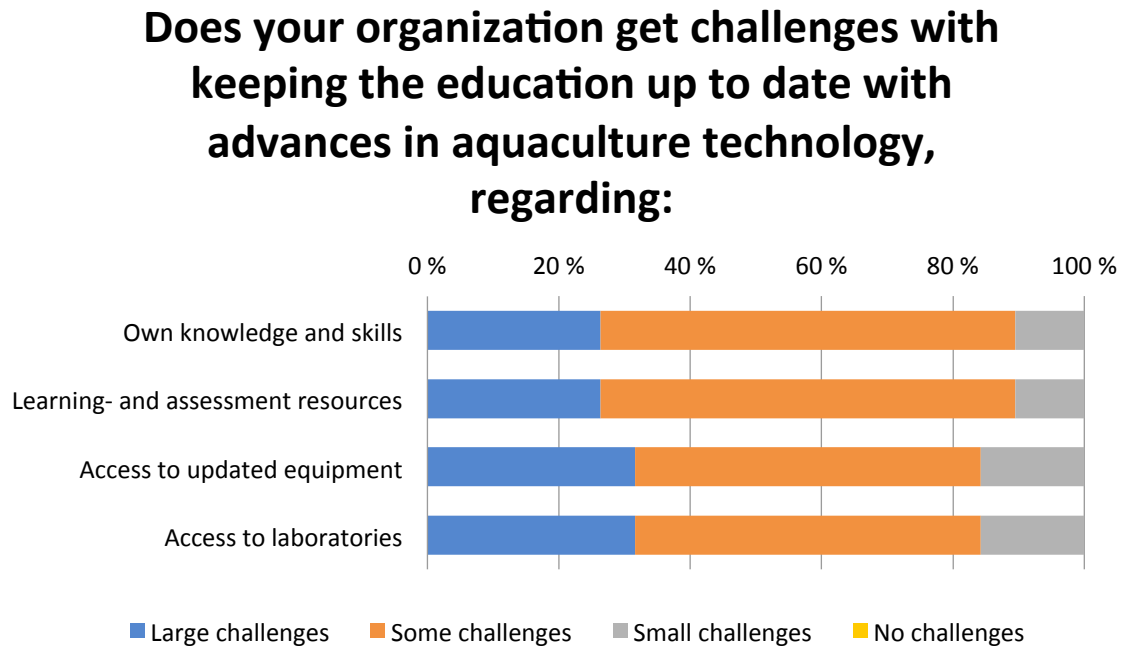

Figure above: What are the main challenges for keeping the aquaculture VET updated?

The staffs at the aquaculture VET school and the apprenticeships system feel they struggle (figure above) with maintaining their own knowledge and skills, as well as development of learning materials, and to offer students access to modern equipment and laboratories

Today only 50% of the aquaculture VET schools in Norway offer aquaculture VET to staff from industry that leads to a national qualification ("fagbrev"). College based attendance training to the students age 16 to 18 are the dominating training activity offered by all the 14 aquaculture VET schools in Norway. Approximately half of the schools reported that their school have been involved in offering shorter courses leading to a certification. 7 out of 20 persons reported that their school offered on-site based training to students from industry that give them a national qualification, confirming the results gathered during the Aqua Nor in 2017 where 50% the aquaculture VET schools in Norway offered such courses. Only one school reported that their school have been involved in distance learning courses, while 4 out of 20 persons mentioned that their organization are involved in flexible courses that include e-learning

Farming industry in Norway, on the other hand (BLueEDU results), would like to increase the share with e-learning and/or flexible training solutions, such that their staff may study when they are in

work at the cages. To close this gap will require development, distribution and sharing of digital learning resources, training of teachers in application of e-learning and distance learning training solutions, and to consider unitization of the curriculum.

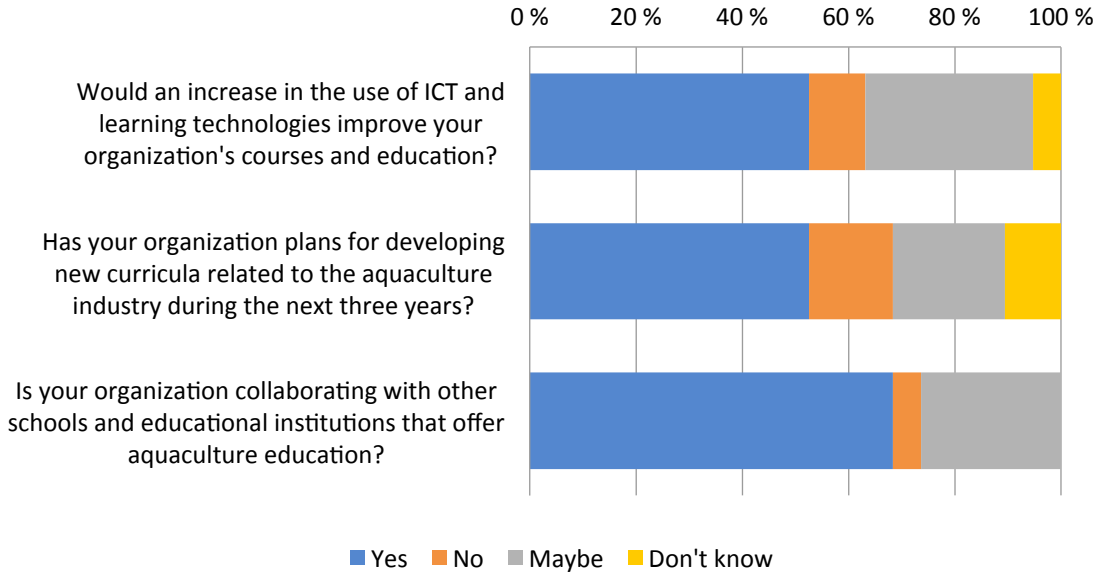

Figure above: What are the plans for further development of the aquaculture VET at the schools?

Half of the responders (BLueEDU results) believed that an increase in the usage of ICT and learning technologies would improve the aquaculture VET offered by their school. The same number of persons reported that their organization has made up plans for development of new curricula during the next 3 years. However, 2 out of 3 persons reported that collaboration between schools that are offering aquaculture VET is even more important.

The new RPL training methodologies and response tools tested and validated by Guri Kunna, is a contribution to increase the usage of ICT and learning technologies in aquaculture VET in Norway (and Scotland too).

The teachers view on using learner response systems was gathered at various stages. Before the course and when the training started, about 50% of the group of teachers were sceptical with respect to applying response systems. This was something new for them. On the other hand, the remaining group of teachers were willing to give it a try, so long as they had technical support during the start-up phase.

The main comments made by the teachers based on their experience of RPL and RT:

a) The iLike response system displays and organizes many contributions from the class, including open text responses. The learners organize the most important words that represent operations in fish hatcheries or on-growing sites, introducing order and classification by working in small groups. One teacher was surprised by how many different ideas the learners managed to offer in only 1-2 minutes, and how subsequent peer learning helped them to organise and structure information within a framework that prepared them for their theoretical exam.

b) The teachers spent time discussing each point developed by the small groups and summarised the results within a list. One teacher commented that they could explain thoroughly why the

various alternatives are correct or incorrect. The learners clearly found this to be beneficial and gave a lot of positive feedback.

c) The teachers found it much easier to test out RPL and apply it together with response systems as a result of the technical support when teaching. This allowed them to focus on the methodology and not which buttons to press on during the first training phases.

   Some commented that it takes some time to get used to the new VET methodology. They found it helpful to work in small teaching teams to better understand how RPL and response tools may be combined to support learning and the learners.

d) The teachers were impressed how often quick evaluations revealed that learners often knew more about a subject than they had realised.

e) Teachers appreciated the insights to their learners' knowledge provided. Quick evaluations helped them to understand which learners had a lot of practical work experience and which were lacking.

1.2 Work based learning conclusions – Scotland

The learner and staff feedback were generally positive (See Output 8)) and Inverness College plan to build on the RPL methodology and re-purpose the multiple-choice question banks and learning episodes within the ongoing development and modernisation of their MA delivery system.

The Scottish team, composed of PLI staff and Inverness College teachers (Associated Partners), noted some strengths, weaknesses and limitations as well as future opportunities during RPL and APL development and piloting. They were related to a range of factors, including; NQ knowledge definitions, technology, pedagogy and all were discussed during a 'Scottish' Optimal project closure evaluation.

4.2.1 NQ observations

Alternative interpretations of the Aquaculture MA knowledge requirement became apparent once PLI engaged with the Inverness College teachers to discuss the multiple-choice question bank for Nutrition and Growth, to be used to support RPL and APL. The underlying cause is elaborated in Output report 6. In summary, some of the prescribed underpinning knowledge statements represent broad areas of knowledge open to different interpretations by each VET practitioner, indicating that they were not sufficiently prescriptive. This led to a series of protracted discussions with PLI staff and slowed down the process of quality assurance (QA) and revision. This is a weakness that hampers the full and effective implementation of APL, which required well defined knowledge requirements to inform the design of multiple-choice questions that reveal whether the learner has the prior knowledge at the appropriate level that can be accredited.

As an aside, during review meeting discussions, it became apparent that the level of knowledge expected of the husbandry operative in the Scottish industry may be lower than the Norwegian expectation. This would appear to reflect a difference in staff roles and responsibilities on a Norwegian salmon cage farm as compared to a Scottish cage site. In Norway it appears that operatives are expected to be able to cover for the site manager in their absence and therefore

require a wider range of knowledge and perhaps deeper understanding of some subject areas in order to cover some site manger tasks and take responsibility for decision making.

Proposed future actions for improvement:

- A detailed analysis of the competences required of Norwegian and Scottish cage farm operatives and site managers, leading to the development of an industry endorsed common competence framework (CCF) that can inform a framework of shared learning outcomes (FSLOs) for VET providers to adopt.
- Revision of the MA in Aquaculture leading to a more detailed definition of the knowledge statements during the next review of the Scottish NOS and MA

4.2.1 Technical

Socrative is primarily a response system for formative assessment, ideally in a classroom. It was pushed it to its limit with its application for work based RPL and APL, but its accessibility and ease of use, has proved its worth. In addition, despite providing enough functionality to recognise individual learners, no accounts were required.

However, there was a lot of timewasting manual transfer of information required in order to link up the RPL results to APL and the transmission of the appropriate learning episodes to support learners undertaking 'guided self-study'. Within a well-designed Virtual Learning Environment (VLE) this would be a relatively seamless and automated process.

The Socrative RT technical limitations to the use of multiple response questions would not have been an issue for the One2Act Eval RT. However, the Scottish team concluded that RT is not to be recommended as the central technology for supporting RPL and APL within the work-based MA in Scotland. However, it may have a place as a secondary approach, in support of the solution proposed below.

It was recommended that a VLE and e portfolio for documenting evidence of practical competence, was far more suitable for supporting continuous assessment at the heart of the work-based MA. The assessment functionality of VLEs is diverse and offers interactive and visual assessment options and gradebooks for recording and retaining assessment evidence. The process of learner feedback is not constrained, as was the case for Socrative, and under invigilated conditions, APL evidence can be gathered and quality assured for submission to the SQA, Scotland's Awarding Body with far greater ease.

Proposed further actions for improvement:

I. The adoption of VLE and e portfolio technology that can integrate the presentation of learning resources with an on-line communication facility and a quality assured assessment process (underpinning knowledge and practical competences)
II. The incorporation of conferencing technology to support synchronous tutor and learner led collaborative problem solving and learning.

4.2.3 Pedagogical

The Inverness College management were encouraging the use of the Socrative RT by their teaching staff during the Optimal project, which influenced its selection. However, for the technical reasons above it is not the most appropriate technology to support RPL, learning or learner support for work-based learners.

Currently, they learn under the direction of their tutor and farm supervisor and are isolated from their peers throughout their programme. There is no opportunity currently for group learning activity. The Inverness College plan to progress with the development of RPL building on the resources and lesson learned but repurposing them for use within an e portfolio system, chosen to reduce the burden of paper-based recording that is onerous for many learners.

The Optimal pilot indicated that the displacement of some of the onerous documentation of paper-based portfolio- assessment evidence with a slick, invigilated multiple choice assessment process to recognise and accredit prior learning would be most welcomed by learners. This change in approach is particularly advantageous to those who have difficulty in writing or expressing themselves verbally, but nevertheless, do have an understanding, which remains hidden due their learning difficulties.

However, during the Multiplier event a note of caution was offered from one industry member who pointed out potential issues with a total reliance on multiple choice within any assessment strategy, including APL. They referred to research evidence that demonstrated gender inequality can arise from multiple choice as a form of assessment, due the greater 'risk aversion' of female learners, compared to males, when completing a multiple-choice assessment. This point is particularly pertinent to the use of the more challenging questions with multiple correct responses, including those where every response provided is correct. For many learners, to select all the given responses to a multiple-choice question as being correct, takes a lot of confidence, and according to the research based evidence provided at the event, a total reliance on multiple choice assessments that included a lot of multiple response questions, could unintentionally disadvantage female learners.

Once completed and refined it will be possible to have all the knowledge requirement within the Aquaculture MA addressed by multiple choice questions which provide a route to APL, once the question set has been quality assured, and are linked to an appropriate 'learning episodes' This resource will support the learners in addressing their gaps in knowledge and understanding though 'guided self-study' allowing them to prepare for reassessment in a series of very specific and narrow areas of knowledge. However, even when complete and fully functional this system will not assess the integration and application of knowledge, which may lead to husbandry operatives with a more limited understanding and ability to apply and integrate their knowledge across subject boundaries.

By contrast the Norwegian final exam is entirely based on the 'integration and application of knowledge' to a given farm problem or scenario (case) and presents a challenge of a higher cognitive level. There is nothing in the SQA system to prohibit the introduction of an element of 'end testing' towards the end of a learners' programme that required the integration of knowledge across the knowledge statements within a Unit, and/or across Units within the MA. And yet, this approach is not currently a part of any providers MA assessment strategy, when it could be.

Proposed future actions for improvement:

I. The further development of RPL and APL approaches using a wider range of multiple choice and other assessment methodology that can be supported by an e portfolio and Virtual Learning Environment (VLE).
II. The development of tutor led asynchronous and synchronous group learning activities, supported by a suitable e portfolio/VLE infrastructure.
III. The development of learner led knowledge sharing and peer learning, supported by a suitable e portfolio/VLE infrastructure and other communication technologies such as conferencing.

IV. The development of learning support for remote learners who have learning difficulties through the increased use of visual media within learning resources and more intensive tutor interventions
V. The development of forms of integrated assessment of underpinning knowledge that requires learners to apply themselves to real farm- based problems and/or given scenarios.

1.3 Aquaculture VET based learning conclusions - Norway

Before applying for the professional certificate test, the candidate must have passed a theoretical examination according to the prerequisites set by the Directorate of Education. This exam will test to what extent the individual candidate has reached the competence levels defined in the curriculum. The exam is prepared centrally. If the candidate does not pass the examination, a new examination may be reapplied at the earliest six months later.

In the pilot with 50 learners, 48 out of 48 passed the national theoretical exam and achieved better results compared to the 3 previous years, where approximately the same number of the learners managed to pass the final exam. The mean score increased from 3.2 to 3.5 on a scale from 1 to 6 (best). This has demonstrated the positive impact of the RT supported RPL applications described above in this report on the classroom pedagogy for mature learners at the Gurri Kunna Upper Secondary School in mid Norway.

At High School and Upper Secondary School (VET) level, assessment will be given with grades. There will always be given grades as numbers, on a scale from 1 to 6. The individual grades have these levels:

- Grade 6 expresses that the student has advanced competence in the subject
- Grade 5 expresses that the student has very good competence in the subject
- Grade 4 expresses that the student has good competence in the subject
- Grade 3 expresses that the student has quite good skills in the subject
- Grade 2 expresses that the student has low competence in the subject
- Grade 1 expresses that the student has very low competence in the subject.

In order to pass the minimum level in a subject, grade 2 is required.

1.2.1 NQ related

The analysis of the Norwegian NQ during year 2 was very valuable phase of the project as it enabled the Scottish partner (PLI) to develop question banks confident that they were addressing the curriculum in the right way for Guri Kunna. The teachers readily adopted selected questions and were appreciative of the use of multiple correct responses which revealed the depth of their learners understanding, stimulated good classroom discussions at the start of a new topic and complemented their own more open and conceptual question sets.

As a result of conversations during the final project partners meeting, it is believed that further 'unitisation' of the Guri Kunna curriculum may be of benefit as this could provide a framework for the development of resources, their distribution and the management of online learning between classes. In addition, it has become apparent as the Optimal project draws to a close that the sharing of on-line learning resources between partners in Norway, Scotland, Iceland (The Icelandic Fisheries College, Arnarlax and Arctic Fish) and Ireland (Galway Roscommon Educational Board and Mowi

Ireland), is of growing interest to aquaculture VET providers in these north European countries farming Atlantic salmon. A 'common framework' agreed between partners will help to support this and unitisation is a step in this direction.

Proposed future actions for improvement:

I. Further analysis and 'unitisation' of the Guri Kunna curriculum to support the future collaborative development of on-line learning resources.

1.2.2 Collaboration

The Optimal project proved that despite any language and cultural barriers, it is possible for VET practitioners from different north European countries to work together successfully to specify and develop learning resources that can be shared and will work effectively within different VET systems and delivery modes. All resources are developed in English Language in the first instance, as the chosen language to support European cooperation. But, for some target audiences (learners) translation into the appropriate national language is requirement.

Proposed future actions for improvement:

I. To continue collaborative innovative VET developments through the application of instructional design methodology, such as story boarding

1.2.3 Streamlining RT methodology

Guri Kunna aims to get even better results by streamlining the methodology during the next courses to come and enhancing the learning between classes. This will consist of applying a combination of quick evaluations to detect the groups pre-knowledge and pre-competence, and training activities that apply peer learning methodology where the most experienced students help explain the correct and incorrect alternatives to their classmates.

It is worth noting that the proposed and tested methodology applies RT that is easy, low cost and quick to use. The feedback from the students may be collected within a timeframe from 'immediate to slightly delayed feedback' during a period of 2-3 days. It is important that the employed learners don't need to invest a lot of time in order to enter a response.

Proposed future actions for improvement:

I. Online response tools to gather data from multiple choice questions or open text input will continue to be applied and the methodology refined and streamlined to optimize the effect of the teaching provided. (See section 2.2)

1.2.4 Teachers continues professional development (CPD)

As described in the Output 7 report, the winning of hearts and minds within the group of aquaculture department teachers was a mission critical step within the Optimal project taking some time and patience. However, after a few months the staff room chat started to develop a positive 'me to' staff mentality as other teachers felt they may be missing out. It became apparent that other teachers in the department, and some from other departments, wanted to try out this 'new teaching method and technology'

The development of the staff needs to continue. It is recommended to continue offering additional technical support during the first class-room sessions, whenever the method is applied by teachers

entering the system for the first time. In addition, due to the intention of adding 'on-line learning' to the 'blend' within future programmes (see 4.1.5 below), consideration will also be given to developing the teachers' skills set as an 'on-line' tutor.

Proposed future actions for improvement:

I. The Gurri Kunna teachers will undertake further development through the application of RT to RPL in order to build up their own experience in gathering and offering feedback.
II. Teacher development in the application of on-line learning and remote tutoring between classes supported by appropriate technologies.

4.1.5 On-line learning

The development and inclusion of on-line learning within the programme is under consideration in order to enhance and improve the learning opportunities between classes. This will follow further analysis and unitisation of the Norwegian Aquaculture NQ/curriculum in order to provide a suitable framework and the help the selection of those subject areas that are most suitable for an e learning approach. This initiative will add to the class-based RT/RPL pedagogy within a new blend (see 1.3) but will never replace it. The employers see great value in learners from their company meeting each other and staff from other companies for an interactive, real time, face to face learning experience led by a well-qualified and experienced tutor.

Partly in response to industry requests, on-line learning will be developed and included for two main reasons; to reduce some of the time learners need to spend in class and to allow learners more time to practice with real and simulated farm-based scenarios (cases) that are similar to the challenge they will meet during their final theory examination.

Proposed future actions for improvement:

I. Collaborative development of on-line learning resources and on-line tutoring to further enhance the Gurri Kunna classroom-based delivery system

1.4 Blended learning solutions

During the exchange of views, the understanding between partners has grown, leading to a clearer recognition and acceptance of each-others Aquaculture VET strengths and weaknesses. The national VET regulatory environments and appetite for RPL were compared (See Output 3) followed by a more in-depth comparison of each other Aquaculture VET delivery and assessment systems (See output 6). The different nature of delivery, work based (Scotland) as opposed to classroom based (Norway) led to different interpretations of RPL and in the case of Scotland APL. The pilots provided hands on experience in resource development and delivery, some of which was collaborative and allowed valuable feedback to be gathered from learners and staff regarding their needs for the future.

In both countries there is a strong will for the continuation of RPL and APL, as the benefits have been proven, but within the context of addressing some weaknesses, and/or changing the emphasis or blend' of delivery approaches. The Optimal VET providers and stakeholders in Iceland (who are interested as a result of dissemination) are all interested in the adoption of RPL within 'blended learning approaches.

1.3.1 Enhancing work-based learning (Scotland)

Scotland wishes to embed RPL and on-line learning supported a VLE and e portfolio in order to improve learning, assessment and communication. The MA learning experience to date has been very farm specific, and the portfolio-based assessment process onerous for learners and staff. In the future a new balance will be found between farm based experiential learning and guided learning, supported by appropriate learning and communications technology and the further development of learning resources. The potential to add group-based learning activities (synchronous and asynchronous) to the mix will lead towards a more 'blended approach' and learners who are better supported by their tutor and peers.

In addition, the current one-dimensional portfolio-based assessment strategy will evolve in three ways:

I. Addition of multiple choice to support RPL and APL, leading to individualised learning and assessment plans targeting the gaps in assessment evidence
II. The introduction of e portfolio visible to and accessible by the learner, their supervisor, tutor, assessors and internal and external verifiers. This will lead to a much slicker and fully automated approach towards the compilation of portfolio evidence of practical competence, as specified by the MA Units and will ease the management of quality assurance required to satisfy the SQA.
III. The introduction of integrated 'scenario' based assessments that could be target real farm problems be based on 'given scenarios' and required knowledge to be applied and integrated.

1.3.2 Enhancing classroom-based delivery (Norway)

The Gurri Kunna team are planning to further develop and streamline RPL applications and the use of RT. They are building on their experience and the strengths of their RPL applications established throughout Optimal. See section 2.2)

In addition, they plan to unitise their curriculum, to create a more detailed definitions of the learning outcomes, building on the initial analysis of their NQ undertaken within Optimal (See Output 6 report). Subsequently, they will select subject areas and specific topics that are suitable for of on-line learning, translating suitable resources developed by PLI during Optimal and developing new resources themselves. Unitisation would also support the increased use of continuous assessment which is under consideration within the proposed 2nd generation tools (see section 2.2)

Their aim is to better support the less experienced learners that want to consolidate their learning between classes, and/or prepare themselves for new subjects before the first class. Supporting scenario-based learning is of great interest, as the integration of knowledge across several subject boundaries helps many learners to prepare more effectively for the national theory NQ examination which requires the same level of cognitive ability.

The emphasis within their 'chosen blend' will continue to be on class-based group learning, supported by the RPL and One2ActEval RT system due to the positive feedback from learners and national examination results in 2019. However, their industry is interested in reducing the class time, and through a combination of improved RPL/RT applications (See section 2.2) and complimentary e learning, the teaching team believe this will be possible during the next phase

1.3.3 Recognising the common ground

Towards the final stages of the Optimal project, a degree of convergence has been evident as both Optimal Vet providers (Norway and Scotland) seek to 'position' different deliver modes within their 'blend' that suits their learners, industry and themselves as providers

More specifically, both VET providers are;

- continuing to develop and embed RPL practices within their delivery systems
- moving towards the greater use of e learning, albeit for different reasons,
- developing scenario (case-based) learning to help learners apply their knowledge to a real or simulated farm scenario or problem and
- both will be operating within a unitised curriculum which will make common learning outcomes easier to identify, fostering collaboration.

Therefore, the teachers at both institutions have similar staff development needs regarding the development of on- line learning resources and on-line tutoring skills. In addition, due to their different strengths, both can assist each other. Scotland can assist Norway with unitisation and Norway can assist Scotland with case-based learning and scenarios, which lie at the heart of their national theory examination system.

2. Future learning technology specifications for RPL/APL

Recommendations regarding the future choice and application of learning technologies differ considerably between Scottish work based learning and Norwegian classroom-based delivery for the reasons provided earlier in this report.

In summary, Guri-Kunna (mid Norway) plan to further develop their use of the One2Act technology which has some implications to the development of the tools' functionality. Whereas, Inverness College in Scotland propose to replace Response Technology with a Virtual Learning Environment and e portfolio, for the reasons given previously as they modernise their future MA delivery, including RPL and other assessment applications.

2.1 The use of VLE and e portfolio within Work based learning

For the reasons given previously, the Socrative Response Technology piloted in Scotland had significant limitations for both learners and teachers when used to support RPL within a work-based delivery system that is centred on individual learning and assessment plans. It is a tool predominantly designed to support classroom pedagogy and group learning, and whilst it was possible to adapt it for use within the Optimal pilot with work-based MA learners, it had significant limitations. These have been referred to be learners (Output 8 report) and by staff (section 1.1 of this report)

2.1.1 Comparative assessment functionality of RT and VLEs

Whilst fully recognising that RT and VLEs are designed for different pedagogical purposes, the table below compares the functionality of the assessment options offered by the Socrative Response Technology and a Moodle VLE.

Number	Question Type	Present in Socrative	Present in Moodle
1	Multiple choice (Select one answer)	✓	✓
2	Multiple choice (Multi answer, marks taken off for wrong answers)		✓
3	Multiple choice (Multi answer, all or Nothing)	✓(limited)	✓
4	True or False	✓	✓
5	Select missing words (drop down boxes)		✓
6	Short answer -Type in the answer	✓	✓
7	Two or more questions in one (Embedded answers)		✓
8	Drag and drop words into text		✓
9	Drag and drop onto image		✓
10	Drag and drop markers/target		✓
11	Drag and drop text / images to create a sequence		✓
12	Matching		✓

Table: Comparison of Socrative functionality with a Typical VLE (Moodle)

The Moodle VLE has considerably more functionality and therefore flexibility within the work-based learning situation. It is also possible to access it via a mobile phone or tablet. In addition, most VLEs can provide individual assessment feedback to learners, if configured to do so, and store assessment results in a personal gradebook. They can provide an e-portfolio function, or interface with more sophisticated e-portfolios to support the assessment and quality assurance of practical skills and competences, which can be a very onerous task within the SQA system.

A more holistic and seamless environment that is intuitive to the users (learners, teachers and those quality assuring the assessment process) can be provided to support formative and summative assessment within the delivery of a work-based NQ.

2.1.2 RPL and APL

For the reasons provided above (see 2.1.1) the VLE/e-portfolio is the technology of choice by all Scottish Aquaculture MA providers. As it can record multiple choice assessment results, it is technically much easier to gather and present RPL results for submission in a form that can satisfy the knowledge requirement of the NQ prescribed in the Units and therefore the SQA.

However, the SQA do insist that the assessment process is invigilated, necessitating the establishment of organisations that are authorised assessment centres for the award. In Scotland, as Inverness College are members of the University for the Highlands and Islands (UHI) that have access to a wide range of centres that have staff employed who could ensure the integrity of the assessment process and validate the learners work as being their own. The administration and experience in operating such systems already exists within the UHI system and can be applied to the aquaculture MA.

2.1.3 On-line learning

The delivery of learning episodes by e mail in response to the RPL results achieved and stored in the Socrative RT was a very inefficient and 'clunky' process within the Optimal pilot. During the next phase, the Inverness College VLE will be configured to navigate the learner to the appropriate 'chunks of learning' according to their RPL results, seamlessly, automated by the VLE. Through the combination of well-designed e learning, linked up to the multiple-choice questions (as defined by the inventory of learning episodes for each of the 5 subject areas), the new VLE/e-portfolio will support and automate the individualisation of learning and assessment, leading to a vastly more efficient and effective VET system for learners and teachers alike.

2.2 The specification of 2nd generation online response tools for VET

Guri-Kunna VET School has applied, tested and evaluated the 1st generation online One2Act tools Eval and iLIke during the timeframe of the project. The goal has been to offer improved training within aquaculture VET to staff from fish farming companies. However, ratings such as the 'Likert scale questions' have not been applied in the testing done in classes.

Based up on these tests, evaluations and experiences obtained during the project, the following design recommendations have been developed for how to design the 2nd generation online response tool whereby unprepared question sets (questions that are not uploaded into the tool) may be applied. This is a higher-level functionality of the tools but doesn't include the detailed translation into "programming languages", which an ICT engineer would need. This would need to be a focussed activity within a successor project, designed to support the design and development of these tools.

2.2.1 **Improvement of One2Act Eval** (Run several questions at once, before or after a class)

The One2Act Eval tool has a wider range of functionality than was applied during the Optimal project. However, it requires teachers who have had some experience with the more basic applications, before adopting this '2nd generation tool'.

The specific future criteria are as follows:

1. It is desirable that the tool supports multilingual usage, including the languages Norwegian, English, Icelandic and Danish.

2. The tool must be designed for anonymous usage in class, with the results stored against the individual learner user in order to make it possible to apply support continuous assessment in the future.

3. Multiple-choice questions should be stored in a database, thus ensuring a single point of access to maintenance, re-usage and sharing of the questions among teachers from several countries. It should be possible to mark which alternatives are correct and incorrect, including when all the alternatives may be correct or incorrect. Don't know should under normal conditions be included as a compulsory alternative.

4. It should be possible to store multiple-choice question in several languages (Norwegian, English, Icelandic and Danish).

5. The multiple-choice question should be organized according to the aquaculture VET curriculum specifications. (This has been demonstrated possible by the Scottish partners during Optimal, when working with unitised and more 'granularized' curriculum). Prep-prepared multiple-choice questions should be prepared for specified learning outcomes within a unitized curriculum.

6. It must be possible to classify multiple-choice questions as Knowledge, Comprehension and Application questions.

7. It must be possible to classify and level the questions according to EQF 3 (Scotland) and EQF 4-5 (Norway and Iceland) frameworks

8. It should be possible to apply non-linear teaching methods, allowing teachers to interchange between the learning outcomes and modules in the aquaculture VET curriculum.

9. The teacher client must be modified, so as multiple-choice questions may be collected from a database, if possible, by setting up and controlling a quick evaluation by applying the teachers' mobile device (smartphone or tablet)

10. It should be possible for the teacher to select several presentation formats for the results from one question:

Other operational user/display features of the proposed 2nd generation One2Acteval system are:

One horizontal bar displaying the share (%) with correct and incorrect alternatives; thus, making it possible to initiate a peer learning session in groups, without informing the learners of the correct or incorrect alternatives and be able to conduct a 2nd voting when discussions are complete. The results should then show how the response from the class has changed.

Horizontal bars displaying the number of learners selecting each alternative; should make it possible to select the number or % of learners selecting an alternative and for the teacher to select and apply their preferred mode of graphical presentation (vertical bars or a circle with bar charts). Teachers should be able to initiate a peer learning discussion in the class and carry out a 2nd voting when the discussions have been completed. The results could then show how the response from the class has changed.

Horizontal bars displaying the number of learners selecting each correct and incorrect alternative; is an option the teacher would apply when explaining and elaborating a learning point to the class. This includes explaining why the correct alternatives are correct, and why the incorrect ones are incorrect.

I. The results from a quick evaluation could be sent to learners' smartphones or tablets when the teacher decides.

II. The tool should contain a service that helps to improve the quality of the stored multiple-choice question sets. That is to apply the results from the previous voting's to indicate for the teachers how well the questions worked in the class.

2.2.2 **Improvement of One2Act iLike** (Run a question one by one in class)

The One2Act iLike would need to be modified as follows:

1. It is desirable that the tool supports multilingual usage, including the languages Norwegian, English, Icelandic and Danish

2. The tool must be designed for anonymous usage in class, though the results should be stored on the individual learner user in order to make it possible to apply continuous assessment in the future.

3. This tool supports application of open text as well as multiple-choice questions. However, the multiple-choice questions should be stored in a database, thus ensuring single point of access to maintenance and re-usage and sharing of the questions among teachers from several countries. It should be possible to mark which alternatives are correct or wrong. All of the alternatives may be correct or wrong. Don't know should under normal conditions be included as a compulsory alternative.

4. It should be possible to apply open text-based questions that are not prepared in advance to a lecture or a lesson. This includes
    a. text presented on a screen or a board and just marked with a colour. e.g. one sentence
    b. text presented on Power Point and just marked with a colour, e.g. some words
    c. tasks or material presented orally to a group

d. multimedia material containing video or simulations

5. It should be possible to apply open questions that are prepared in advance to a lecture or a lesson. Those should be linked and organized according to the aquaculture VET curriculum specifications.

6. The multiple-choice question should be linked towards and prepared for unitization of the curriculum. That is to divide the curriculum into “smaller” pieces of information.

7. It must be possible to classify multiple-choice questions as Knowledge, Comprehension and Application questions (Chapter 1).

8. It must be possible to classify and level the questions according to EQF 3 (Scotland) and EQF 4-5 (Norway and Iceland) frameworks.

9. It should be possible to apply non-linear teaching methods. That is, teachers may interchange the modules in the aquaculture VET curriculum.

10. It must be possible to apply multiple-choice questions. Multiple-choice questions should be stored in a database, thus ensuring single point of access to maintenance and re-usage and sharing of the questions among teachers from several countries. It should be possible to mark which alternatives are correct or wrong. All the alternatives may be correct or wrong. Don’t know should under normal conditions be included as a compulsory alternative.

11. It must be possible to run single votes and double voting’s to enhance and support peer-learning activities. The teacher should decide when to present the results to the class from single votes and from double votes.

12. The tool must support tag-words functionality.

13. The tool must let end-users enter and write free text.

14. The tool must order words entered as free text.

15. The tool must display the highest frequency words as a word cloud.

16. The tools must be prepared for application on digital blackboards, including making notes on the blackboard an export the joint dataset as pdf-files.

17. It must be possible to display the results from two voting’s, either as one graph followed by another vote, or as two separate voting’s where the results are displayed together after closure of the last voting.

18. Voting’s should support both immediate as well as delayed feedback loops. That includes voting’s that may last for several days. It should be possible for the teacher to evaluate the status of open and on-going voting’s from their browser.

19. The results from a quick survey or a multiple-choice question should be sent to learners' smartphones or tablets when the teacher decide to do it.

20. Results of the learners' voting's should be stored as individual data sets, thus supporting continues assessment during work-based learning and inclusion of individualized learning plans

For both tools above, it is desirable that the teacher client may be designed in such a way that it may be operated from a smartphone or a tablet. This will make it easier for the teacher or instructor to "tell their stories" without technical interruptions during their teaching practices.

2.3 Experiences with application of response tools within aquaculture VET

A response system is technology designed to promote and support

- Collecting responses – immediately or nearly immediately (up to 2-3 days response time)
- Communication – change how groups of students communicate
- Collaboration – change how students collaborate within a group
- Interaction – affect how students may better help each other during learning phases

In a classroom context, a response system consists of a set of technologies (hardware and software) that allows a teacher or instructor to gather real-time responses from the students.

- The teacher/instructor poses a quiz question about a subject that's just been taught, using some suitable medium, for instance like a written on a blackboard or just shown an exercise from an exam on a projection screen. This question can be multiple-choice, or a free text answer may be submitted. The students give their response to the question using either a mobile device (laptop, mobile phone, or other handheld device) or a computer.
- Once the students have submitted their answers to the question, the teacher gets a graphical display of how the students voted. Based on how the students voted and on how many got the answer correct, the teacher will then process to explain what the correct answer was, and why it was the correct answer.

Using the response tools in this fashion directly benefits both the students and the teacher:

- The teacher gets instant or nearly instant feedback on the students' level of understanding. If a high proportion of students submit a wrong answer, it's an indication that the students don't follow, and that the teacher should recapitulate the section pertaining to the question.
- Because the quiz question covers a particular subject, the students get instantaneous feedback on whether they understood the being taught. Answering a quiz question in class also gives them a chance to actively take part, as opposed to being passive listeners during a lecture.

Response systems are currently not frequently used in Europe, nor in VET based learning or in any other courses. This is indeed the situation in primary school, upper secondary school, universities as well as in vocational education and training. Teacher educational institutions don`t address them in their educational programs. Nor do they train teachers to use them to change the way students communicate and interact within a class, despite this indeed affects students learning and progress as they may receive continuous feedback, while at the same time they may provide continues feedback to the teacher.

There are many response systems available on the market. Without some kind of thoughtful methodical approach response systems can only be one of many other entertaining tools that can be used to spice up a lesson or training event. However, what makes response systems like iLike unique is its flexibility in following up a quiz. Other response tools require that teacher log into the tool again, create a follow-up question and then publish it for the students in making a new quiz question. This is time consuming, and the teacher risk losing students' attention during the process. With the iLike response systems the teacher is completely independent of the publishing tool to bring up a new question for reconciliation. The teacher can immediately write down a new question for example on the white-/blackboard, or just simply ask the question orally and then use iLike to run a new vote.

This flexibility is often both useful and necessary. Imagine that the teacher has asked a question and he/she can see from the responses that a large part of the class has obviously misunderstood the question. Then it will be necessary to quickly rephrase the question and immediately run a new vote. The teacher can also imagine that one of the students comes up with a very good question related to the subject that he/she would like to run a vote on. With iLike and Eval this is easy to do, and without any long process of login before running the vote.

Before we mention effects obtained by using iLike, we would like to present methodological rules that make use of response systems most time-efficient, a kind of a checklist for the teacher. To make the voting session as effective as possible, it is a great advantage for both teacher and students to log in onto the system at the very start of the lesson. In this way, the teacher interface will be ready to use before the session, and students will only need to bring up the voting page to be able to vote. The checklist of what happens in the beginning of a response technology supported lesson can look like this:

- The teacher log in on the teacher interface and create a session code
- The students log in on the voting page with your session code (this goes quickly because the students have saved a shortcut to the voting page on their mobile devices)
- The teacher checks if there is sound coming from the PC (so that the students clearly hear the ticking sound that signals that a voting session is in progress)

How to start up using response tools?

It is recommended to start applying tools that let the teacher run questions one by one in the simplest possible way, for instance as iLike do:

- The students are presented with a multiple-choice quiz question, where one or several alternative may be correct. The question can be shown on a blackboard; a flip over chart; a projection screen or any written medium
- The students are given time to think and/or discuss between themselves
- From the teacher client interface, the teacher starts the voting session (a timer/countdown mechanism can be used, if desired)
- Each student casts a vote as to what the correct answer is, using the voting device. The vote closes and the results are shown to the students in the form of an histogram
- The instructor will comment the various alternatives and highlight the correct one – explaining thoroughly why it’s the correct one; and why the other ones are incorrect
- The lecture proceeds as normal

Many teachers use response tools as an element of everyday teaching, for example, to ensure that students have understood the reasoning behind the lecture or to ask control questions during teaching. What happens after the question is asked and the voting is done, is up to the teacher. However, it is important that the student responses are discussed, as the summary made by the teacher is very important for the students' experience of learning.

- Teachers usually need some time to learn how to ask the good questions. A candidate for a good question is not a question where all students fail to answer correctly, or everybody answers incorrectly. A good question manages to initiate discussion among the students, thus encouraging students to engage by taking part in the discussions.
- Teachers that work together in small groups and help each other to start using and discussing the new tools, will to a higher degree manage to change their pedagogical methods and start applying response systems
- Instructor training gets best effect if it is divided in two steps. First a technical oriented course where the teacher learn how to operate the software and ask simple questions. This must be followed by own practice in class, before a new course start discussing how to apply various methods to provide and receive feedback.
- After a period with training, many teachers start increasing the number of connectional questions where students must mix knowledge from several areas within a course in order to answer the question.

Application of response systems makes it easy to find problem areas and like this, the lecture can be organized in a much more convenient and time-efficient way. Teaching can now be focused on the parts of the curriculum the students are struggling with. The fact that the students have time to discuss each task before the voting session takes place helps them feel less afraid to ask questions, as one realizes that they are not alone in having misunderstood.

If used properly, application of response systems has the potential to benefit both the teacher and the students.

After extensive evaluations including surveys; group interviews and individual interviews, we have a clear understanding on how the teacher and the students see their respective roles in using tools like iLike and Eval, and what the main benefits are.

The teacher perspective

For the teacher, a response tool acts as a real-time gauge of whether the students follow the VET lecture. Posing two questions during a lecture is enough for the teacher to get a good feel of whether the students have understood the main points, or if further revision is needed.

The teacher faces two main challenges in using iLike and Eval:

- It takes time to develop good conceptual questions – they could be constructed so as to provoke common misconceptions or misunderstandings. Using a response tool like iLIke and Eval to test textbook knowledge (rather than conceptual understanding) doesn't harness the potential of the response tools, and questions should be designed accordingly
- Classes become (much) more interactive, and consequently more unpredictable, in the sense that the teacher may need to adjust explanations according to how the students answer. If the majority of students get the answer wrong, a more in- depth explanation is needed than if most of them get it right.

Obviously, some care is needed to make the quiz questions an integral part of the VET lecture, but the teacher would not have to completely restructure the way a subject is taught. It's more a matter of putting one conceptual question every 20-30 minutes of lecturing.

The student perspective
Based on our evaluations, the students see several immediate benefits of applying response tools like iLike and Eval:

- Increased involvement – the students are no longer passive listeners, but are given a chance to actively take part in classes
- They can submit their answers anonymously (without the embarrassment of giving a wrong answer in class), and they get frequent and regular feedback on whether their answer was correct

The iLike is often used in conjunction with group discussions – i.e. the students will discuss between themselves in groups before submitting an answer, and afterwards in the class. This gives them a chance to discuss curricular matters in class, which is not often the case even in VET.

Timed versus non-timed voting sessions
The response tools iLike and Eval have been designed to be used in small and large classes, whereby maintaining order and discipline is a priority. After a group discussion, the teacher will want to start up a voting session. But it can be challenging to restore order and attention in a class in which many students have been engaged in serious discussion. In particular, to make all the students, some still fiercely involved in the discussion, aware that a voting session is about to begin or to stop may be challenging.

- To aid the teacher in restoring order for the voting session, the response tools can be set to play back a "ticking clock" sound during the countdown (see below).

The teacher's role
Based on the feedback we've received, it's critically important for the students that the teacher

- Thoroughly explains what the correct alternative was, and why, and why the incorrect alternatives are incorrect
- Puts a lot of effort into stimulating the discussion between the students – in some classes, the discussion can be a bit heavy-going unless the teacher aids the process along. This problem is exacerbated if the students don't know each other very well

Response tools like Eval and iLike are designed to

- be used in a range of teaching and learning styles by use of students own PC/MAC, mobile devices or any combination of those
- be used together with any kind of software used by the teacher
- be merged into the storytelling of the teacher or the instructor
- be used "on the fly" if for instance a student provide an interesting and relevant question during a class session
- provides teachers and students with instant feedback on learning effect in small as well as large student groups
- be used in distance teaching and/or onsite learning

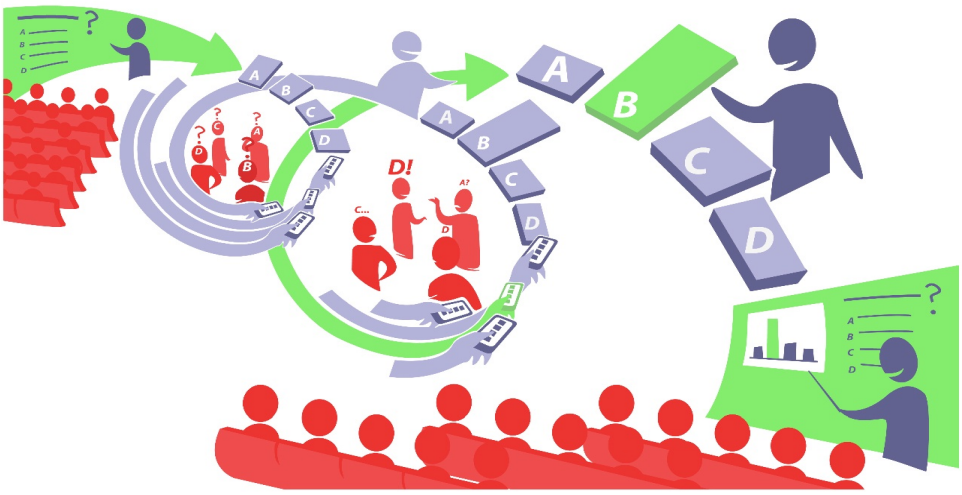

Figure above: Use of response tools - Classical (one loop) versus Peer instruction (two loops). The question is posed on the blackboard. After the first or second loop the teacher explains why the correct alternative is correct, and why the incorrect alternatives are incorrect.

The classic method works as follow:

1. During the training session the students are asked a quiz question related to the topic being taught about.
2. Students are given a few minutes to discuss the question and its alternatives in small groups (about 3-4 groups per group).
3. They vote individually using an iPod
4. After the vote is closed, response distribution is shown to the students. The teacher goes through the various alternatives, highlights the correct one and explains why it is correct and why the other alternatives then are less correct or incorrect.

The peer instruction method has the following steps:

1. During the training session the students are asked a quiz question related to the topic being taught about.
2. Students are given one minute to work with the quiz question individually
3. They vote individually using an iPod
4. Students are then given a couple of minutes to discuss the quiz question in small groups a few minutes (about 3-4 groups per group).
5. Before they vote again
6. After the second vote is closed, two response distributions are shown to the students. The teacher goes through the various alternatives, highlights the correct one and explains why it is correct and why the other alternatives then are less correct or incorrect. Another option may also be to invite to a class discussion.

The differences between classic and peer instruction:

Classic:

1. Quiz question
2. Group discussion
3. Individual voting
4. Closure: thoroughly explanation after the voting session

Peer instruction:

1. Quiz question
2. Individual work
3. Individual voting
4. *Group discussion*
5. *Individual voting*
6. Closure: thoroughly explanation after the voting session by the teacher or as a class discussion

The key difference between these methods is the number of votes per quiz. By the use of peer instruction, students are able to work with quiz questions on their own, take a stand and vote, before they go into the group discussions. In the classic method they begin to discuss as soon as they have been presented for the question.

Small group discussions
Regardless of method, the teacher can encourage the students to discuss the quiz question and its alternative in small groups for a couple of minutes. Time is not spent in placing the students in groups; they discuss with the person/s beside them. The group discussion gives the students a chance to be more involved in the actual teaching, as well as enabling them to learn from one another by hearing other students' opinions and arguments. Experience shows that students profit subject-wise from discussions. Students are given the chance to learn from each other and to be more active in class.

A last check routine before the polling: "Please wait"

- Right before the teacher starts the polling, he/she asks the students if "Please wait" has appeared on their mobile device. (The mobile quickly assumes slumber mode.) In order to receive the alternative answers and to participate in the voting students must have this page open.

Teachers' explanations afterwards: where learning is involved
When a polling closes the results may appear automatically. The teacher then goes through the results, highlights the correct alternative and explains thoroughly why the various alternatives are correct or not.

As regards learning by the students, this is the most important stage concerning the use of response tools. If the teacher simply chooses to point out the correct answer and then continues on, the students' experience of learning is minimal. If the teacher on the other hand chooses to elaborate on the different alternative answers and explains why these alternatives are right or wrong, the students' experience of learning increases considerably. In many ways this stage is about giving all students a possibility to learn, not just those who have answered correctly.

Another twist: encourage class discussion:

- Instead of the teacher immediately commenting on the response distribution, it may be beneficial to encourage students to comment on their answers aloud to the class. This gives the students an opportunity to discuss the topic with other students and can lead to a larger and constructive discussion among students.

This session must not replace teacher's explanation, but be a supplement. The teacher should have the last word and explain why the various alternatives are correct or incorrect.

Then what happens?

- After this, teaching proceeds as usual. The whole procedure – from the time when the question is posed, the students' discussion, the voting itself and the teacher's explanation afterwards – may be done within only five minutes.