International Specialised Skills Institute 2016

BEYOND 25 YEARS OF SKILLS ENHANCEMENT

State Government Victoria Department of Education & Training

Improving Plumbing Training in Australia considering the Implications on Global Health

Robert Funston

An International Specialised Skills Fellowship

Sponsored by Higher Education & Skills Group,
Department of Education and Training, Victorian Government

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i. EXECUTIVE SUMMARY

Plumbers have always had the responsibility of considering public health in their everyday work practices. But with growth in population, the world becoming smaller through easier access to travel and living in a multicultural world, there is a growing need to understand more about managing water safety and security, safe sanitary practices and the prevention of disease spreading through our communities.

Today's plumber has to understand the importance of their role in the community. Plumbing training has to stay connected to the global health issues and understand that their practices may affect our community and in turn may affect another community. Plumbing training has to include a high level practical skill, problem solving and critical understanding.

Through this Fellowship opportunity, the Fellow investigated the possibility of redesigning plumbing training into an inclusive collaborative training model that will incite learning and increase the plumber's capacity to learn. Traditional plumbing training is extremely skills focussed. With new technologies becoming a major influence in plumbing design there is an even greater need to reconfigure and enhance plumbing training.

The Fellowship provided the opportunity for the Fellow to enrol in the short three-week course 'Decentralised Water and Sanitary Systems' at IHE-UNESCO, Water Education Institute, Delft, Netherlands. This course allowed the Fellow to study plumbing and plumbing technologies as well as teaching methods used in this University.

Apprenticeship training requires particular attention. The typical apprentice is young, inexperienced and usually not academically motivated. Visual resources have proven to be effective in apprenticeship training as well as interactive practical demonstration. This needs to be a major consideration in the design of plumbing resources. Redesign has to include the inclusion of LLN (Learning Literacy and Numeracy) to support learning and an element of self-directed research and problem solving activities to encourage positive learning outcomes.

At IHE-UNESCO, training is handled in an inclusive, cooperative way. The lecturers start every lesson by explicitly explaining the lessons purpose, the tasks the students will perform in order to achieve the lesson outcomes and how the outcomes apply to 'real life' application. By taking the time to explain lesson outcomes, the students have a clear understanding of not only the learning for the lesson but in knowing the purpose of the lesson, have a better understanding of assessment outcomes. A photo, a cartoon, a video or some kind of drawing is then discussed by the class to engage the more visual learners in the class. In order to assess and access students' prior learning, the instructor performs some simple class levelling exercises, questions, discussions and simple scenarios. The class is then presented with a lesson on the topic at hand, some problem solving methodologies and various templates to work with. The class is then divided into small groups, (Communities of Practice) (Lave and Wegner 1991.) to work collectively on solving a problem related to the subject at hand. This work is then assessed by the instructor as either a presentation delivered to the class or a documented assignment. The students are then individually tested.

The Fellow feels that by rethinking the design of plumbing training, by providing a program that considers inclusive collaborative methods of learning, interactive resources and current technologies, the opportunity for improving engagement, learning and problem solving skills will increase. Improvement in training will increase the capacity for a better informed plumber and increase protection of community's water safety and security and prevention of potential health risks.

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ii. ACRONYMS & ABREVIATIONS

CBC	Competency Based Completion
RTO	Registered Training Organisation
CoP	Communities of Practice
VET	Vocational Education and Training
DWSS	Decentralised water supply and sanitation
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VBA	Victorian Building Authority
PTMGA	Plumbing Training Moderators Group Australia
VTPMC	Victorian Training Plumbers Management Committee
NGO	Non-Government Organisation

iii. DEFINITIONS

CoP

Communities of Practice (Lave and Wegner, 1991) are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.

Decentralised

Disconnected from utility networks

Ecosan

Ecological sanitation

Rainwater harvesting

Water collection from rooves

Treatment

Safe management of sewage products

1. ABOUT THE FELLOW

Qualifications

- Graduate Certificate in VET Practice
- Diploma VET Training and Assessment
- Certificate IV Plumbing and Gasfitting
- Certificate III Plumbing and Gasfitting
- Licensed Plumber
- Cert III in Horticulture

Robert Funston has been employed by Chisholm for the past ten years as a trade teacher teaching Cert III and Cert IV plumbing and for the last two years has been employed as Senior Educator in Plumbing and Water Industries. The Fellow has continued to teach Cert IV plumbing specifically teaching:

- Plan, size and layout domestic plant disposal systems
- Design and size sanitary drainage systems
- Design and size stormwater drainage systems
- Design and layout below ground drainage.

The Fellow has also undertaken part time lecturing in sustainable plumbing practices at Swinburne University and has enjoyed strong working relationships with local water authorities, writing training resources and educating practicing plumbers in trade waste and drainage.

The Fellow started his career in horticulture, before moving into plumbing, running his own medium sized plumbing business for fifteen years, focusing on new homes and renovations, maintenance on larger commercial buildings and hot water service repairs. The Fellow then transitioned into larger facilities and facilities management.

Sustainable ways to protect the environment and protecting the community by providing safe, clean water, manage waste water and the management of our water resources have been a major influence in the Fellow's learning and training journey.

2. AIM OF THE FELLOWSHIP PROGRAM

To advance the Fellow's plumbing knowledge through the completion of the 'Decentralised Water Supply and Sanitation' short course at IHE-UNESCO (Institute for Water education) in Delft, Holland. Through this Fellowship, Funston aims to:

- Identify Australia's role in global water safety and security
- Identify opportunities in plumbing training in Australia.

Specific areas of knowledge advancement the Fellow aims to advance specific areas of knowledge in different technologies for small scale water abstraction and treatment. This includes developing knowledge of different technologies for small scale water supply and treatment and providing more options for people and communities who currently do not have access to reticulated water supplies.

The Fellow aims to also disseminate the knowledge gained throughout Fellowship Program to the VET Plumbing Sector and Plumbing Industry primarily through the findings of the Fellow's report to be circulated to plumbing teachers throughout Chisholm Institute and Victorian plumbing teachers via the Plumbing Teachers Moderation Group (PTMGA).

The report will also be circulated to Industry bodies including the VBA and local water authorities as well as RTOs. Presentations and information dissemination is intended also at the Annual Plumbing, Sheet metal, Copper Smithing, Instructors Association (PSCIA) conference.

3. THE AUSTRALIAN CONTEXT

Safe drinking water and sanitary hygiene are an essential part of our everyday lives. In Australia we pay our taxes and the Australian Government takes care of the risk of water borne diseases and hygienic sanitary conditions for all Australians. Highly regulated plumbing practices and trained plumbing practitioners also ensures the water safety and quality for our community. But we are the fortunate ones. The majority of the global environment does not have the luxury of safe drinking water, water security, safe hygienic living conditions, nor do all global communities have solid regulation and training to support good, safe practice. Most people in the world have to consider every sip of water they take every day.

With the global economy becoming smaller every day, sickness and contagious diseases have now become a major consideration for all communities around the world. In recent times we have encountered some significant threats to the health of our nations. Zica virus, SARS, Ebola, Cholera and Diarrhea are all diseases that can be easily carried and spread through water or unsafe hygienic practices.

Australia needs to consider its role in a global response to these global health issues. Australia's best opportunity in assisting the global environment on issues of safe clean water and sanitary hygiene is in the delivery of quality education, not only to Australia's apprentices and plumbing practitioners, but to the rest of the world. We have the expertise, the capacity, the resources and exemplary working examples to support training that will encourage world's best plumbing practice and safe clean water for all. This report will further inform on Australia's training capacity.

Australia has embraced new technologies that will assist in water security for this nation such as: water desalination plants, storm water retention systems, sewer harvesting, water recycling, surface water capture and rainwater harvesting. New technologies are essential to the growth of Australia and the protection of its water supply; however, new technologies are almost pointless unless we have the training to match the technology. Plumbers need to know and understand the sustainable benefits of these technologies and how to install and maintain new technologies. Plumbing training needs to align with these trends to maintain a healthy community attitude to the importance of water safety and security.

The importance of well-trained plumbing practitioners has never been more crucial in the areas of preventative health, sustainability of water resources, climate change and new technologies. Plumbing practitioners are traditionally very poor at maintaining currency in their trade. Current plumbing training curriculum does not seem to be engaging the majority of our apprentices, nor is it promoting the importance of their role in the community. We need to reform and re design plumbing training delivery, so that plumbers are inspired to engage in training and promote active participation in the importance of continuous professional development. Plumbers are at the front line in the protection of the community's health and as a consequence, their training requires the highest rigor and consideration.

Apprentice training

The plumbing apprenticeship in Australia requires an apprentice to be employed for four years on the job, including three years formal training (off the job training). Once formal training is completed, the apprentice then sits a 16-hour (two and a half day) practical exam with the plumbing regulator. On successful completion of these requirements the apprentice is deemed a registered plumber. The registered plumber can only work as an employee of a licensed plumber. To become a licensed plumber, the registered plumber must undergo further study and sit further examinations set by the regulator.

The typical Apprentices are predominantly male, 16 to 22 year old school leavers. The apprentice is trained under the Competency Based Completion (CBC) system. The plumbing apprentice is required to complete 87 task orientated competencies to complete their plumbing training.

3. THE AUSTRALIAN CONTEXT

The CBC system of training requires the student to perform a task or set of tasks to gain competency in each subject. The CBC system of training is a suitable system for the more mature learner with a considerable amount of experience. However, in regards to the 'typical apprentice', the Fellow questions the capacity of the young inexperienced learner to understand the system they are learning within, understand the requirements of each subject and how these requirements relate to their workplace. Furthermore, the Fellow questions the order that the units of competency are delivered in and that the units of competency are not necessarily designed to promote good plumbing learning. Instead the learning outcomes and the order of the delivery of competencies are often governed by financial constraints set by the RTO. For example, the learner is expected to start and finish a unit of competency in a relatively short amount of time (so that the RTO can collect its funding dollars) and the learner often never gets the opportunity to revisit the learning gained in that competency.

Gaps in plumbing apprenticeship training are glaring and obvious. Basic plumbing principles and basic hand skills are not taught until required by a competency. If basic plumbing principles were taught at the beginning of the course, it would give the apprentice a greater chance to apply these principles throughout the course and make the training more authentic. Foundation skills, basic hand skills and basic plumbing principles are imperative and need to be consistently applied and assessed before an apprentice can move into any skill based assessment. Starting training without these basic understandings places the student at a disadvantage and fails to create an ideal future learning environment. Handing an apprentice a prescriptive document with measured outcomes is disengaging and is an uninspiring and limiting way to commence the initial stages of training.

Plumbing training in Australia needs to broaden the horizon of the Australian plumber. The plumbing training curriculum needs to affect a realisation that although plumbers must be proficient in a large group of skill sets, their importance in terms of preventative health, water safety and security and

sustainability are equally important. Water safety and security and sustainability needs to be included in the curriculum and we must not assume that the learners will understand all the implications derived from learning skill sets alone. Considering that many of our learners are early school leavers, without the will to be high scholastic achievers, it is imperative that we inspire and motivate the students through an engaging curriculum. The opportunity for a secure valuable career and career advancement needs to be stressed, as real global opportunity exist for the well trained plumbing professional.

Challenges for Plumbing Training

A teacher's time with the student seems to be taken up with the stresses associated with assessment and compliance. Our learners are young and inexperienced. The students require teacher's undivided attention. If their learning is constantly interrupted by teachers distracted by compliance issues, the ability to maintain the student's attention is lost. Maintaining consistency in training and the control of funding and government spending in training across Australia is essential. Compliance to government rules is critical to the success of educational excellence, but teachers facilitating the learning and the administration of compliance issues is seriously damaging the teacher's ability to perform at their best.

The quality of apprenticeship training is threatened by funding cuts to VET training. In 2012 the Victorian Government announced $1.2b over four years in funding cuts to TAFE's, 300m were cut in 2013. In response to government funding cuts, RTOs reduced the number of permanent teaching staff. Plumbing training cannot provide current, consistent training, nor keep up with added compliance responsibilities, growth, updating of current resources and the introduction of new technologies with a casual staff. The casual staff are required to perform at the same level as permanent staff, when the casual staff are typically less experienced in teaching, compliance, resource development and competency requirements. This leads to mistakes, a reduction in the quality of training delivered and an increased demand on the remaining permanent teachers.

Challenges like updating training resources, meeting the ever changing requirements of our students, keeping up with new technologies and plumbing regulations, combined with an increase in student participation, are difficult to achieve and maintain at any time. Funding cuts can only result in the compromise of training quality.

Consistency in training and cooperation between different RTOs has been placed in jeopardy by the introduction of contestable funding. RTOs have been placed in the position of being in competition with each other for funding and student numbers. Contestable funding has all but decimated the cooperative support network that once existed between plumbing teachers from different RTOs.

The one saving grace that plumbing apprentice training enjoys is that all apprentices are examined at the end of their training by the VBA, the Victorian plumbing regulator. The registration exam does maintain consistency in the apprentice's final registration

exam. All apprentices around the state have to complete the same practical exam, conducted and assessed by the same six examiners, employed by the VBA.

Opportunities

The Fellow has returned from IHE-UNESCO with an understanding that Australia has the very best and the most advanced plumbing systems in the world and therefore has a very important role to play in worldwide water safety and security and community hygiene. Australia has an advanced understanding of safe drinking water and sanitary hygiene and the latest technologies associated. We also have consistency in plumbing practices, supported by highly regulated codes and standards, a robust apprenticeship system, scientific and practical expertise, good facilities and infrastructure and the potential to offer quality training to the world.

Reform and redesign of our plumbing training programs will secure our position in the world as the leaders in plumbing practice and plumbing training. Redesign of plumbing courses will invigorate the learner and promote a healthy attitude towards such an important career.

Many community sewerage treatment plant projects around the world have been constructed and failed because the operation and maintenance procedures have not been followed. This is not necessarily because of a lack of will, but more through lack of training. In many instances the facility was built and financed by a government agency or an NGO and the community would be expected to maintain the facility, without the proper training given. Operation and maintenance often requires some specialised training supplied to several of the local community members to keep the facility operating over a long period of time. Australia's knowhow and capacity to educate in some of these situations is second to none.

Many problems can also occur in water treatment facilities. Overdosing of chemicals, cleaning and maintenance of biological filters, laying sand filters, pump and valve choice, pump and valve maintenance and flow rates are all issues that require the expertise of trained individuals.

Trade and industrial waste training and technologies are essential to many communities. Crippling blockages caused in pipe networks caused by grease and oils that stop pipework systems from working at all. For communities that have little rainfall water reuse is essential. Water contaminated with industrial waste cannot be reused or discharged into water sources or back into the ground water table. Australia's technological expertise and knowledge in this area becomes critical to the water safety and security in these areas.

Pipeline design and pipe laying is key to delivering water and waste from one area to another. Australia's understanding in pipeline design and pipe laying principles and the training offered to Australian workers is suitable for delivery to communities businesses around the world.

3. THE AUSTRALIAN CONTEXT

In these times, pumps are an essential part of many waste, water treatment and delivery models all around the world. If the pumps are not working the whole system

will not operate. Pump technologies is an emerging necessity for many communities worldwide. Training on pump operation and maintenance and repair, provides opportunity and solutions for a vast range of plumbing applications.

Australian's have adopted rainwater harvesting as a part of our everyday lives. This is not the case for all communities around the world. The education on rainwater harvesting in many parts of the world is not only on installation and maintenance of rainwater harvesting systems and technologies but convincing communities that rainwater harvesting is a perfect way to collect and store water. Many communities are not convinced that water from this source is not safe. Australia has existing technologies to prove that we can provide safe drinking water from rainwater.

New plumbing technologies, plumbing practices, community health, ever changing regulations, new materials fittings and fixtures, increasing water and sanitary infrastructure and the maintenance of the world best practice we enjoy, are all reasons why mandatory continuous professional development should be introduced into plumbing practice.

The potential for contagious diseases entering our country are very real. Maintenance of our plumbing standards has never been more essential. It is very difficult for the experienced licensed plumber to remain current in all the necessary changes to our industry without entering into some kind of training. One way of assuring that all plumbers are informed on all current practices is to introduce mandatory continuous professional development. This can be achieved by not allowing a licensed plumber to renew a license unless the plumber has undertaken some current plumbing training and re-skilling.

4. IDENTIFYING THE SKILLS AND KNOWLEDGE ENHANCEMENTS REQUIRED

The Fellow identified the following as key Skill Enhancement areas:

- To advance the Fellow's plumbing knowledge through the completion of the 'Decentralised Water Supply and Sanitation' short course at IHE-UNESCO (Institute for Water Education) in Delft, Holland
- Identify Australia's role in global water safety and security
- Identify opportunities in plumbing training in Australia.

The Fellowship provided the Fellow with the opportunity to extend his plumbing knowledge through participation in a three week course at IHE-UNESCO Institute for Water Education. The aim was to extend the Fellow's plumbing knowledge in plumbing and plumbing technologies.

Australia is a harsh environment, with similar conditions to other parts of the world and Australia has learnt how to protect its water sources and build infrastructure that will maintain our water quality and security. Australia has the expertise, the rigor around regulation and provides a high level of training to its plumbing practitioners. With such a solid base of knowledge and exemplary infrastructure we have a responsibility to train the world in water a safety and security and sanitary excellence.

5. THE INTERNATIONAL EXPERIENCE

This study was conducted at IHE-UNESCO Institute for Water Education, Delft Netherlands. The Fellow enrolled in 'Decentralised water Supply and Sanitation', a three-week short course offered by the Institute which ran for three weeks, five days a week from late June to mid-July 2016.

The Institute provides education to more than 15,000 water professionals from over 162 countries, the vast majority from the developing world. The Institute offers a unique combination of applied, scientific and participatory research in water engineering combined with natural sciences, social sciences and management and governance. Since its establishment the Institute has played an instrumental role in developing the capacities of the water sector's knowledge and skills of professionals working in the water sector.

IHE-UNESCO carries out educational, research and capacity development activities that complement and reinforce each other in the broad fields of water engineering, water management, environment, sanitation and governance.

The Institute is nestled amongst a beautiful old world Dutch community situated approximately one hour by train, west from Amsterdam. There are three universities in the town so it has a high student population from all corners of the globe.

Upon entering the Institute buildings there is an instant feeling of a very real, rich focus. This feeling is supported by the idea of research and discovery displayed on the walls and in the reception area and the murmurs of discussion and conversation filling the large foyer, meeting areas, restaurant area and hallways. This was a place that had the answers for some and a conviction of research for all. This rich feeling of focus and passion never wavered over the whole three week period. The Fellow was privileged to experience this extreme level of focus, passion and willingness to learn.

The Institute and their business partners, offer scholarships to students from around the globe whom are impacted on a daily basis by the conditions of their environments and have a desperate passion to solve the water and sanitary conditions affecting their local communities.

'Decentralised water supply and sanitation' (DWSS) is an elective subject for the Masters in urban water and sanitation, Masters in water science and engineering and Masters in water management. Students currently completing their Masters in the areas described and students enrolled in the DWSS short course, combined for this elective subject.

The Fellow enrolled into a class consisting of 30 students from 25 different countries, with a vast range of social and cultural backgrounds, different living and working conditions and varying natural terrain and surroundings. The common thread in the class were that all of the participants were very intelligent with a passion for making their environments better by improving water safety and security and sanitary conditions for the community.

The course addressed a complex variety of challenges faced by communities all over the world on a daily basis. From the Favela's in Brazil, to the deserts of Africa, to the warzones in Syria, the refugee camps in Lebanon and the flood plains in Pakistan.

The intended purpose for this Fellowship was to learn about new technologies in water and sanitation and to make recommendations that will have an impact in an Australian context. It was only a couple of days into the course that the Fellow realised that Australia has a very advance knowledge of new technologies, is very advanced understanding of water safety and security and is positioned very well in terms of regulation and management of plumbing infrastructure.

The Fellow was absolutely fascinated by the lecturers and the training methods used in the training delivery. The delivery methods inspired the Fellow to completely change the intended aims for this Fellowship, to a realisation that Australia has much more to offer. Australia has the capability to offer the best practical plumbing training in the world. Australia has the capacity to train its own practitioners

to the highest standard and can have a major impact on solving the global community's water and sanitary issues by offering practical training solutions to the rest of the world.

Funston is confident, that by adapting some of the learned teaching methods used in the DWSS course, combined with some innovative teaching approaches we can vastly improve our existing plumbing training and offer world best practices to the rest of the world. Working closely with students from all over the world has incited both an emotional and a practical response. The Fellow gained a whole new perspective on the value of collaborative thinking, networking, communities of practice and the social and cultural differences that affect and inform decision making.

The Fellow was challenged daily by the privilege afforded to him by living in a civilized world and studying amongst classmates who were living in areas that were hard and harsh and difficult to manage. The Fellow's practical knowledge, however, was well utilised in the classroom when an assessment required some practical approaches to solve a problem during classroom activities.

The course surprisingly, offered a far more important outcome. Once the course had begun the Fellow realised that, after understanding the world's water and sanitary issues, there is a greater need for education on solving the water and sanitary problems. The Fellow understood that there will be new technologies being developed all the time and although this is important, education is far more important. There was also a realisation that Australia is very advanced in new technologies and technological advancement. For the successful introduction and implementation of these technologies we need to educate people on their usefulness, functionality, operation and maintenance.

The Fellow is now in a position to teach and influence his students and peers on the importance their roles in the community, in maintaining plumbing sustainable practices and identifying possible training opportunities for achieving better water safety and security globally.

Decentralised Water Supply and Sanitation

Course outline

- General introduction to water supply and sanitation situations in small town, peri-urban areas and urban slums etc.)
- Water Supply Systems: Water sources, supply systems, source selection, water supply service levels, spring catchments and sand dams, wells and pumps, rainwater harvesting, small-scale water treatment methods.
- Facilitated by Saroj Sharma PhD, MSC – Associate Professor of Water supply Engineering.
- Management aspects of DWSS: Participatory planning and evaluation of DWSS systems, financing and cost recovery, institutional arrangements and operation and maintenance aspects.
- Facilitated by Dr.Martin Mulenga – Senior lecturer in Sanitation/Sanitary Engineering and Klass Schwartz PhD, MSC – Associate Professor of Water Governance
- Sanitation Systems: Ecological sanitation (introduction to ecosan, basics of conventional wastewater treatment, relevant treatment technologies, ecosan and agriculture, greywater treatment and reuse, linkages between ecosan and Millennium Development Goals). Faecal Sludge Management, Low-cost Sewerage and Drainage.
- Facilitated by Mariska Ronteltap PhD, MSC – Senior lecturer in Sanitary Engineering, Maarten Siebel PhD, MSC – Associate Professor in Environmental Technology, Stephan Reuter CEO, BORDA and Schertenleib PhD, Senior Researcher Eawag, Swiss Federal Institute of Aquatic Science and Technology.

Decentralised Water and Sanitary Systems class of July 2016
IHE-UNESCO, Delft, Netherlands

6. KNOWLEDGE TRANSFER: APPLYING THE OUTCOMES

The Fellow intends to disseminate the findings and recommendations contained in this report in several ways:

1. Present outcomes at stakeholder and industry meetings

- VBA Victorian Building Authority
- South East Water
- Employer meetings
- PTMGA Plumbing Training Moderators Group Australia
- VTPMC Victorian Training Plumbers Management Committee

2. Presentations

- PSCIA Conference – Plumbers Sheetmetal and Coppersmiths Industries Association
- Integrated into student learning
- RTO Registered Training Organistion

3. Integration into course delivery

- VET in Schools
- Cert II Plumbing
- Cert III Plumbing and Gas fitting
- Cert IV Plumbing and Gas fitting

4. The Report will be sent to

- Victorian Building Authority
- South East Water
- Plumbing Trainers Moderation Group Australia
- Plumbers Sheet metal and Coppersmith Industries Association
- Registered Training Organisations
- CEO Chisholm (Maria Peters)
- Director Engineering Electrical and Trades, Chisholm (Andrew Kong)
- Manager Water and Plumbing Industries (Bryan Ornsby)

7. RECOMMENDATIONS

To address issues such as preventative health, changing environments, water safety security and climate change, consideration must be given to the improvement in the delivery of quality plumbing education and training. We need to undertake a global approach to plumbing training and deliver not only skill sets but an understanding of the implications and importance of good plumbing practice and principles. We need to teach our learners how to learn, how to research, give clear guidance in the expectation of the task at hand and an understanding of the implications of the outcomes of each project.

1. Design training programs, better suited to our learners

The Fellow learned from his international study that even in high level environment, the learners must be taught how to learn, how to research, how to communicate and value the experience of others. The Fellow gained an enormous amount of confidence whilst learning at IHE-UNESCO, by understanding the level he needed to study at, understanding the work requirements and knowing that he had other people around him prepared to assist in the learning.

Plumbing apprentices deserve the same respect shown in their learning journey. Apprenticeship training is so task orientated, the time constraints, the amount of tasks the apprentices are required to perform have all had a detrimental impact on learning. By improving the learner's capacity to learn, engagement, interest and inclusion will follow.

Competency Based Completion (CBC) allows a student to move ahead and finish trade school faster. This is assisted by the existing self-paced training model. Training our apprentices in new learning techniques will enhance the capacity for more students to move through the program at a faster pace. This will provide benefits for the learner and financial benefits for the RTO.

2. Training the new learner

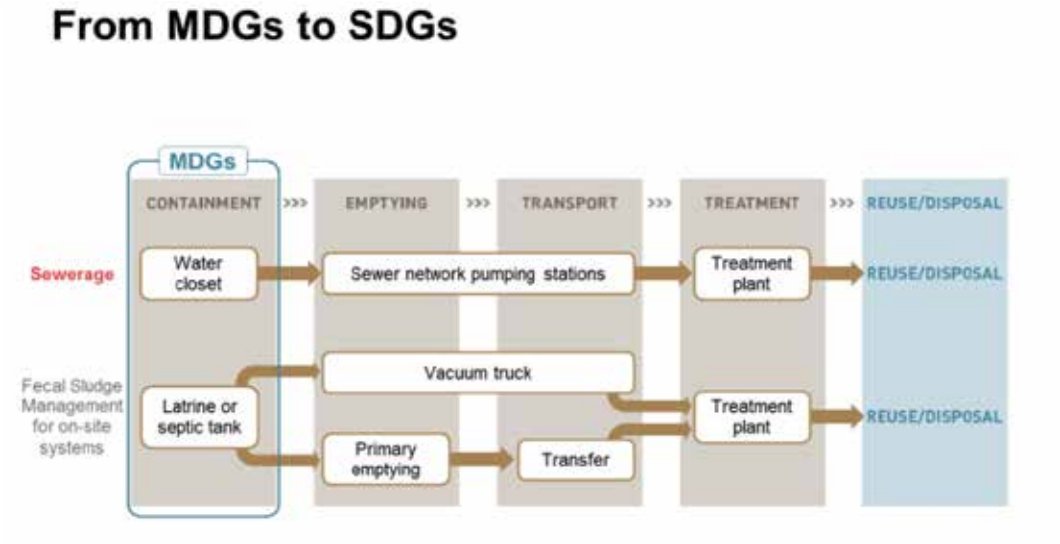
Plumbing trainees would benefit greatly by starting their training with an introduction of basic plumbing principles e.g. fall/gradient, flow rates, pressure, combustion, thermos syphon etc. followed by an introduction to basic hand skills using a vast range of tools and materials and equipment.

3. Positive training methods to enhance learning and improve engagement

- Teaching problem solving methods. Given a problem to solve, students construct a matrix. Excel spread sheet e.g. Vertical columns = stake holders; Horizontal columns = possible solutions; Fill in all corresponding squares - stakeholders against all solutions.

7. RECOMMENDATIONS

Small example of problem solving matrix:



Source: Compendium of sanitation Systems and Technologies. 2nd Revised edition (2015)

- Communities of Practice groups working together to discuss and solve problems. Promotes discussion, teamwork, encouragement, added ideas and thoughts, different experiences.
- Research projects in groups or individually, given a set of instructions the learner is to research an issue e.g. manufacturers of a product, find the most suitable for a given scenario, why, cost of installation, maintenance requirements, installation regulations. This situation teaches research methods, product capability, working effectively with others, problem solving, and installation requirements. The student has very quickly learned much more than just the skills required for installation.

The Fellow aims to broaden his knowledge in these simple techniques, with the idea that this model of teaching and problem solving can be modified into simple scenarios and tasks suitable for apprenticeship education and training.

4. Simplify learning resources

The majority of our learners are not scholastically orientated and are very visual, experiential learners (Kolb, 1976). Providing our learners with an enormous amount of text has proven to be ineffectual learning method as it is uninspiring and demotivating to our learners.

It was proven to the Fellow on his recent study, that teaching techniques that include clear concise resources specific to the topic only, combined with clear instruction and some simple learning techniques, to be engaging, inspiring and gave the Fellow a greater capacity to learn. Simple pictures, drawings and photographs are a very descriptive way of reducing text and our learners respond extremely well to the use of video presentations.

Work shop and practical workstations need to reflect the fact that the majority of our learners respond best to visual and experiential learning methods. Workstations we build need to be interactive, they need to work. E.g. If we are teaching a student to run a sprinkler irrigation system, we need to show the student a working sprinkler system and the student practical tasks should also be fully operational at the end of the task. Current plumbing competencies do not require any of the practical elements of a competency to be operational. The correct operation of any system would be the true test of an

assessment. The addition of an operating system to any assessment would surely increase student, engagement, interest and satisfaction

5. Mandatory Continuous Professional Development

New plumbing technologies, new plumbing practices, community health, ever changing regulations, new materials fittings and fixtures, increasing water and sanitary infrastructure and the maintenance of the world best practice, are all reasons why mandatory continuous professional development should be introduced into plumbing practice.

The potential for contagious diseases entering our country are very real. Maintenance of our plumbing standards has never been more essential. It is very difficult for the experienced licensed plumber to remain currency in all the necessary changes to our industry without entering into some kind of training. One way of assuring that all plumbers are informed on all current practices is to introduce mandatory continuous professional development. This can be achieved by not allowing a licensed plumber to renew a license unless the plumber has undertaken some updated regulation training, refresher course, or product development course.

6. Assessment Methods

Assessments at IHE-UNESCO not only provided the opportunity for clear assessment but the opportunity for further learning. If plumbing assessments include questions that require further research, scenarios that require additional investigation or practical tasks that require the practical project to operate correctly require fault finding scenarios or diagnosis, we have the potential for increasing lateral thing and problem solving skills and hand skill development.

7. The importance of plumbing training

It needs to be stressed to plumbing students the importance of their role in the community. Preventative health and hygiene of the community, water security, safe drinking water are not to be understated in the shrinking global economy we live in. Our students are the people who will responsible for installing, maintaining and operating our water and sanitary infrastructure.

The training offered needs to maintain its rigor, our students need to be engaged, and the students need to be made aware of the responsibilities that will be bestowed upon them upon attaining their qualification and registration. Our students need to understand that they are a part of a professional community that are world leaders. They need to be made aware that they are responsibility for maintaining a very high standard of preventative health and water safety and security, and that the rest of the world can learn from them high quality plumbing practices. The training has to inspire the students to succeed and understand the importance of their training and the responsibility of their position in our global community.

Government

- Maintain adequate levels of funding.
- Maintain high level of curriculum scrutiny, reflecting current industry trends and regulation.
- Regular consultation with RTOs on delivery methods.
- Review Competency Based Completion (is this the best system we could be offering our students).
- Further consultation on compliance administration.

7. RECOMMENDATIONS

Industry

- Collective approach with regulator, water authorities, product development industries, RTOs and trainers to inform curriculum content.
- Consider global water and sanitary issues and sustainability in the design of course content.
- Support trade training not only as employers, but by investing into the future of the plumbing industry by means of contributing to classroom activity, sponsorship and knowledge sharing.
- Consider mandatory professional development as a means of maintaining practitioner currency.

RTOs

- Continued support of networking opportunities between regulator, industry and especially other RTOs.
- Careful consideration of permanent staff numbers in order to maintain consistency in training.
- Support, encourage and invest in innovative training delivery.

The Fellow

- Keep teaching staff informed on new developments in global water and sanitary issues, new ideas and provide a transparent view on issues that may affect quality training.
- Lead and support innovative approaches to plumbing training.
- Lead support a collaborative network between regulator, industry, RTO management, staff and students.
- Conduct regular masterclass sessions to support consistent teaching.
- Conduct regular feedback information sessions between teachers and students.

Education

- Design quality resources and assessments, considering global water and sanitary issues, the learning cohort and introduce effective learning and study methods.
- Construct practical workstations that better reflect operating workplace simulation.
- Maintain high level of collaboration and cooperation between colleagues and students

8. REFERENCES

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8. REFERENCES

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International Specialised Skills Institute (ISS Institute) – The Awarding body

The ISS Institute exists to foster an aspirational, skilled and smart Australia by cultivating the mastery and knowledge of talented Australians through international research Fellowships.

The International Specialised Skills Institute (ISS Institute) is proud of its heritage. The organisation was founded over 25 years ago by Sir James Gobbo AC CVO QC, former Governor of Victoria, to encourage investment in the development of Australia's specialised skills. Its international Fellowship program supports a large number of Australians and international leaders across a broad cross-section of industries to undertake applied research that will benefit economic development through vocational training, industry innovation and advancement. To date, over 350 Australian and international Fellows have undertaken Fellowships facilitated through ISS Institute. The program encourages mutual and shared learning, leadership and communities of practice.

At the heart of the ISS Institute are our individual Fellows. Under the International Applied Research Fellowship Program the Fellows travel overseas and upon their return, they are required to pass on what they have learnt by:

- Preparing a detailed report for distribution to government departments, industry and educational institutions
- Recommending improvements to accredited educational courses
- Delivering training activities including workshops, conferences and forums.

The organisation plays a pivotal role in creating value and opportunity, encouraging new thinking and early adoption of ideas and practice. By working with others, ISS Institute invests in individuals who wish to create an aspirational, skilled and smart Australia through innovation, mastery and knowledge cultivation.

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Industry:

- South East Water

Professional Associations:

- Victorian Building Association (VBA)

Education and Training:

- Chisholm Institute Plumbing and Water Departments
- Plumbing Trainers Moderation Group Australia (PTMGA)
- IHE-UNESCO
- Fellow students from UNESCO courses
- Richard Hutchinson – Plumbing teacher, Chisholm TAFE

Report writing mentor:

- Andrew Kong, Executive Director, Chisholm Institute, Engineering, Technology & Trades

Workplace mentor:

- Bryan Ornsby, Manager Plumbing and Water Industry, Chisholm Institute

Industry mentor:

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