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Quality Management: Quality Techniques

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Abstract

This report is written in the context of the Quality Management course at the BTH School in Ronneby, Sweden. It fulfils the assignment attached to the Quality techniques managed by Nina D. Fogelström (nina.dzamashvili@bth.se).

1. Introduction

In our days, establishing quality in a corporation has become essential. The market competition has forced everybody to adapt its process to produce and deal with services in a more efficient way. The corporation are now considered as complex systems divided in many subunits that should interact together to establish the right end results. In order to perform and improve its own development process, corporations should establish an internal quality system. This can be done by using quality techniques such as training. The following report presents the importance and impact of training inside a company. This will be done by showing what training can solve in an organization, and especially for defect prevention. A presentation of different kinds and models of training will also be presented as well as a discussion about the pros and cons of using such quality method.

2. What can training solve?

Training is in dictionary.com [1] defined as “a development of skills or knowledge through instruction or practice”. Inside a company, training is an activity that helps people to be more skilled. By preparing a task, repeating a process, or be helped by someone to do something in the right way, you are training to perform better. The authors think that training is an activity that can be used in all of the company's areas. As it touches the people and staff, this method can be used everywhere there is people who have an impact on the business progress. To tell something about the defect prevention areas on which training could have an impact, the authors have chosen to give three examples as all the activities could have been selected.

-Requirements definition: It is possible in this area to improve people capability to resolve definition ambiguity. It is true in this area that there are several methods to detect and create the right requirements definition. But sometimes, people need to be trained to these methods because they can be new, or inexperienced to its process. There is a French method which is name LAPAGE which help to define all the attributes and class in an application. By using this method, you can be sure that you will obtain BCNF relations (Boyce-Codd

Normal Form – Database relationship structure). Training could be useful in this example, as someone could teach the method to the employees responsible for requirements definition. It will provide more experience as it would be taught by an experienced person. Training in this case will lead to more experience and more automation as the methods is divided step by step and easy to apply. It will also give better results because the method is proven to give a good application structure, so it is improving the quality.

This method example could be described in the same way for any kind of method that would make the requirements definition easier. The lectures could also describe real cases, and good tools to help making this definition. It could show how to store data, make reviews or establish a good discussion with the customer to facilitate the task. The teacher or trainer could create some ‘virtual’ examples to put the employees in the real situation and show them step by step where mistakes are normally made, how to avoid them, and in the end evaluate their performance by giving critics. This will lead to more experience, less uncertainty, and less fear when the employees establish this requirement definition. It is also possible to train people storing the requirements data and decisions taken to establish a database that could be useful for the next projects. It will give real data to focus on when making decision, and people will be trained to use these data to accelerate the process and find the good solutions.

-Estimations: In an unpredictable environment such as software project management, making estimations especially in costs and time is highly complicated and risky. Every project is unique, each customer is different, and several hazardous events could occur. Mr. John Nicolas explains in his book [2, chp.9-10] that making estimations is a question of experience. By seeing more and more cases, and by making estimations, you can learn from the other mistakes, but also from yours. The more cases you can study and evaluate, the more predictable the results will be for next projects depending on the specified area (e.g. cost and time for making the delete function for an object in a JSP web shop application). In such domain, training could be really helpful. It will provide knowledge and more experience to the employees, which is highly important to obtain success. Inside a company, it could be possible to organize some seminars on which experienced project manager could explain their theory about time and cost estimation and give good tips to improve in this area. A trainer could show articles, documentations, or teach methods that provide more knowledge in making estimations. Training in this case would lead to more skilled people, less risk in making the estimations in the

same way. In a larger vision, it will lead to more benefits, as the company will accelerate its processes. It will be possible to focus on the most difficult areas of the project, they will be more well known and their estimations more accurate.

-Using tools: In most of the company's areas, the employees are using tools for any kind of task. You can use software to make estimations, make the accounting, testing the application, or just coding the application. All these tools are part of the company's policy. Each firm uses different tools that is why training is necessary for the employees, and especially when they are newcomers. The benefit of training people to use tools is essential. It is by using these tools that people will learn to perform as the company's discipline wants the thing to be done. It is also possible to discuss all the advantages that the tool will give to your company. You can take the example of mail discussion and reports application. If you don't teach your employee how to use such software in a fast and efficient way, you will lose time in your project process. Following standards in communication and programming is highly important. If you do not teach your staff to use the tools in the same way, you could create chaos. Imagine how things could go if everybody use mail in different front, colours, head title, or if people are using different way to call their coding variables. It would result to non understandable files which would be too hard to use. In this area, training is a good way to improve quality, and avoid mistakes as described above. Some lectures could be done to show the employees how to use the tools in the right way. It is always better to have someone who explains you how to use the tools in a certain way. Indeed, this person can show you the benefit of this special use, and you will see less resistance to apply the standards as the result are more proven.

As we have seen in these examples, training seems to be a good quality technique to improve the people's behaviour and their skills. It is sure that having better staff will solve problems such as lack of knowledge, lack of certitude, and lack of discipline. In term of defect prevention, it is always good to be more skilled to face more problems without losing time and money. The more skilled the employees are, the less errors and failures will occur. The authors think that training should be used in all the software project areas. With appropriate evaluation of where it is needed of course. It is important to keep the good knowledge balance and efficiency between the people.

3. Different kinds of training

As have already been mentioned, training is a very large and very fundamental part of process improvement and organizational growth, thus it is

natural that there are many different ways to conduct training, and interpretations of what training is. Obviously, we cannot cover all of them; we had to limit our scope. We created a list of different methods that we could investigate further; looking at the list we found that many of these methods could be split into the two general groups of personal and of group training. Where the personal training group containing methods for personal training, which is different methods for increasing a person's knowledge or keep it up to date in a personal manner, not in groups. And the second group, group training for more group-oriented methods. With those groups established, we selected a few different methods out of each to discuss more in detail. The selection was not very scientific, it was entirely based on what felt right to include. Training and learning are closely bound to echo other, learning is by Tom DeMarco and Timothy Listener defined as occurring when the you take account if what experience have shown [4, p.210], and isn't that what training is all about? Giving and forcing a consideration of experience? Thus, we find that learning is an important subject in the context. We will include a few techniques for learning and teaching at the end.

4. Methods for personal training

You can train your self in order to be on the edge of your area or increase your knowledge in neighbouring areas.

4.1. Continuous environment awareness

When you are working, you are getting more experience but you forget what you have learned in school. You have to stay up to date what is happening, new ways to improve you process or new ways of attacking a design problem (for example new patterns).

So, what can you do keep your knowledge at the edge of exploration in your area? You can read research literature, students' literature and join mailing lists. These different types of literature are meant to give you different views of you field.

The students' literature gives you a retrospective view. This is what you have learned in recent years, the basics details; you might have missed that this gives you new ways to look at problems.

Research literature gives you new techniques and new ways of structuring your work, things that no one has ever thought about.

There is much information about different things in various locations. For example, you can find both articles and books in libraries. They cost very little if

anything at all. You can find students literature, research literature and specialist literature. This resource can be very big and very helpful in your progress. Librarians can be very helpful in finding relevant information about a specific subject.

You can also search for and buy literature in other places. For example, you can subscribe to specialist book clubs or magazines so that you do not have to go to the library to search and wait for it but receives new issues or information of new books to your home. You can also subscribe to mailing lists covering relevant areas, where you can read and discuss the new things that you have read about.

By reading your students literature and other literature you should have read, and by reading research-literature to keep yourself at a higher level than you otherwise would have done. This could be done by reading these literatures on your bus or train back and forth from work. Every day you try to find out something new. This is not specific to software technology but it is specifically important in software since there is a rapid improvement rate in many areas related to computers science. You have to keep yourself up to date.

Your company can help you, and as a company you can encourage people to further develop themselves. Provide the magazines that discuss what you are trying to develop. Make sure that everyone that wants to, has access to these magazines not only one or two persons. You might develop some type of library activity. The locals' libraries might not have the magazines that you want your employees to read. You should encourage but be careful not to enforce it, learning and training are hard to enforce and can result in a contra productive environment. Your employee should feel that they learn because they want to. Try to encourage an active discussion between your employees.

The good thing about this is that you keep yourself up to date with new techniques. The advantages of this should be quite obvious, a person who is allowed to keep updated with his or her environment will know of possibly newer ways to do things and thus be able to bring new ideas into the company. We believe that people are actually interested in those subjects too and thus will be happy about being encouraged to keep an eye at the news.

Considering the side effects of email lists, if you do not have appropriate email filters you will get a lot of unsorted email and may lose something important in the mess. Another disadvantage, which is based on the person's ability to question sources of information, is the possibility that someone may

state something without having enough knowledge and thus possibly spreading false information.

4.2. Broaden personal knowledge

There are more to do than to keep your knowledge within your technical area, you can broaden your personal knowledge.

This can be very useful for both you and your company. Employees that not only understand their own area but also understand the other areas within the same organisation are strengthening the organization and eases the communication within it. For example if you work with requirements and you know how and why the other needs the requirements, you might write them in a way that better suits how they will be used, compared to how you would have written them if you had not known. The same is true for other areas, if you do not know what your PM is going to do with your time report, you might not care if you do it right. But if you have knowledge about what they use the information for, you might do it more carefully. Some of the authors of this report have experienced the side effects of not having any idea of why something is done, during projects in school.

You can find this information mostly within your own organisation, as the areas, which are interesting in this case, should be possible to find within the organisation. You can get this information by walking around and speak with people about what they use your information for. You can also improve your writing skills to become more easily understood. This you can be done by talking to the information responsible to get writing tips. Nevertheless, remember that their job is not to teach you, you have to be careful not to take all of their time.

When you are thinking about other areas then your own you have to make a context switch in your mind this takes time. And if you are doing this too much you might end up spending more time switching tasks than doing actual work. And the probability of that you mix these areas together increases.

5 Methods for group training

This chapter describes three common forms of group training. They are Seminars, Discussions and Lectures. These are very old and well known methods to teach people things. They are not mutually exclusive of each other, the best way is to have a mix of the different methods and choose the one you think is most suited for the specific event.

5.1 Seminars

At a seminar you present your work within the area and learn by listening to what others have been working on. This form of group training is best suited for a narrower group of people that work with the same type of things within the company. It requires that the people involved know at least a part of the field in detail so that they can bring something to the seminar that other learn from and to be able to understand what the others are teaching them. It requires that all of the participants prepare themselves before the event in a quite thorough way which takes time and therefore costs money. If the group consists of the right people it is a very efficient form of teaching. It is not enough to have a teacher that knows the area well; in fact there might not even be any need for a teacher in the respect, only a leader that manages the presentations and discussions.

5.2 Discussion

A discussion is quite similar to a seminar but there are no presentations of work from the different people that participate in the discussion. Instead they might have been presented with some material to read up on before the discussion or there might be a presentation of the information in the beginning of the discussion. A discussion requires the participants to have some knowledge beforehand but not to the same degree as in the seminar. Discussions are also best suited for people with interests in the same areas.

5.3 Lectures

Here there is a much stronger part for the teacher than in the other two methods. The teacher is in control of the entire lecture and is leading it. The quality of the lecture and how much the pupils learn depends greatly on how good the teacher is. There can be room for questions from the pupils that can steer the speed and quality of the lecture but the major part relies on the teacher. The pupils so not have to have as much of a prior knowledge as in the other two methods. Of course they have to have some prior knowledge but they do not have to prepare themselves as thoroughly for this specific event as they do have to do for the other two methods.

6 Ways to teach or learn

There are many ways to teach or learn that can be used in different contexts. Two selected contexts and three different ways of training are described and discussed in this chapter. These teaching techniques

can be used both in group training and individual training scenarios.

The ideas and the division of the techniques and contexts used in this chapter are influenced by C. Chen et al and their article [3]. But they are generalized in this report. In the article by C. Chen et al [3] the focus is on training people in the use of a software system. The techniques and conclusions drawn in their article can be used in a broader range of training situations, not just for software training.

6.1 Training context

There is an almost indefinite amount of different contexts to perform training in, but since it is very difficult to work with indefinite sets it is convenient to divide the contexts into larger groups. There are still many contexts even if they are gathered in categories; this report focuses on two of them; Face-to-Face Training (F2FT) and Online Asynchronous Training (OAT). The basis of this selection is that these two contexts are very wide and cover most of the cases of training that are relevant in Software Quality Management, training in software organisations is mostly conducted in person or via different online sources.

6.1.1 Face-to-Face Training

Face-to-Face Training (F2FT) is another name for in person training, the basic meaning is that the teacher and the pupil are at the same location and can see and hear each other. The fact that you are at the same location makes it easier to communicate information to each other and it is also much easier to adopt the training to the persons that are there to learn. By adopting the training it becomes more efficient and the pupils learn more in a shorter time. In F2FT it is common that it is not just a single individual that is taught but a group of people. The reasons for this often stems from the fact that F2FT costs money and the more people that are taught at the same time the more people the cost is split on and in the long run it costs the company less. The teachers time costs and even more so if it is a teacher from an in house department that would have been working on regular tasks if ha/she had not been teaching. It can also be difficult to gather many people at the same time to perform the training, especially if they are from different parts of the organisation. Another drawback is that the speed of the training has to be adjusted so that everyone can keep up, some pupils may want to speed things up while others think that they are wasting their time when things are progressing so slowly.

6.1.2 Online Asynchronous Training

Online Asynchronous Training (OAT) is training performed over the internet or at least via computers. Here it is not possible or at least not common to perform the training in groups. Often the pupils are scattered over an area with largely differing size, they can be in opposing offices or on the other side of the earth. In this respect OAT has a large benefit over F2FT; it is possible to train people in the same ways that are located far from each other. To be able to train them using F2FT you would have to transport them to the same location, and this bears a great cost. Another benefit is that the teacher only has to build the training once, when it is used he/she does not have to be present, everything is in the computers. The advantage is of course that you save money. But there is also a drawback with that; the training is shaped exactly the same for every one that is trained, if this person needs extra help he/she has to locate the teacher before receiving the necessary information. The training has to be thought through much more thoroughly before it is implemented in an OAT. You have to make sure that nothing is forgotten and that as wide an audience as possible can follow the training without problems. A benefit of OAT is that the pupil can proceed with the training at his/her own speed; there is no need to try to follow a lecturer's speed or wait for slower pupils to catch up.

6.2 Training techniques

These training techniques can be used in both of the above described training contexts, and of course also in many other teaching situations. The three techniques described in this section are Instruction-Based (IB) training, Exploration-Based (EB) training and Behaviour Modelling (BM) training.

6.2.1 Instruction-Based training

In Instruction-Based training (IB) the lecturer presents everything to the trainee directly, you simply preach out all of the facts to the pupil at once. The pupil has a very low control over the process; it can be referred to as stuffing of information into the pupils and hoping that it stays there. This technique has the drawback that it is less tailored to the pupil's interests, which makes it easier for the pupil to lose interest. And when it is combined with OAT, which in itself is less tailored towards individual pupils it can quickly become too much to take in. Because of the fact that IB presents materials that the trainer chooses to display and at a pace the trainer chooses it is more likely that the pupils will not be interested in the materials that are presented to them. This is aggravated because of the fact that there is little or no feedback to the trainer regarding the pupils' reactions to the presented materials.

And as C. Chen et al says in their article [3]:

"If trainees are bored, they are less likely to perform well or have positive reactions to their training experiences."

6.2.2 Exploration-Based training

In Exploration-Based (EB) training, the assumption is made that the pupil learns much more by sitting performing simulated tasks instead of just learning the theory. By performing tasks set up by the teacher the pupils gain insights and learn in a better way, there is no stuffing of information. Instead it is learning by doing. OAT does not provide the teacher with monitoring of the pupils, as is common in F2FT. This can lead to that the pupils become distracted and start doing something else than the training that they are supposed to do. This is a danger that can make the EB method less efficient than other methods when you use OAT.

6.2.3 Behaviour Modelling training

Behaviour Modelling (BM) training is in some ways a hybrid of EB and IB. The pupil models the behaviours of their teacher. This gives BM many benefits; the method inherits many of the best characteristics from IB and EB training. It has the benefit that EB also has that it is not just stuffing of information and additionally the benefit of IB that it is more controlled by the teacher and therefore the pupils are not as easily distracted. According to C Cheng et al [3] BM is the method that is the most effective in F2FT and even more effective in OAT.

7. General Advantages of Training

After having presented the different methods and models that exist to train people, we can now try to sum up the different advantages that training provides to a company.

Training is applicable when there is staff or people, which have a role in the company. And it is true that the main goal of training is creating a personal improvement. Training provides people that are more skilled, more aware people, and more disciplined people. This is highly important, because it is the employees that create the company's force. By using more training, you can improve the quality of the tasks carried out. This improvement can be seen in terms of time, money, and quality. Improving the people's capability is also improving the company's potential [4, Chapter 32]. Using training techniques such as lectures, discussion and seminars will lead to more motivation. If the employees are becoming more skilled because you give them the opportunity to evolve, they will feel more committed because they can improve with the top management help, and they can use this gain of knowledge for the business benefit. If the people are trained to use tools or make decision, they are also

committed to the process development. They can give their opinions about using such methods or any models. It will create a better environment because people are involved in the process definition. If they can give feedback about the methods learned, it will give better results as the right solutions that fit the company's policies will be applied.

Training is also a good solution to deal with discipline and standards problems. It allows people to learn the right way to perform things. As the learning is standardized, everybody knows how to do things clearer. Chaotic environments can be avoided by using training, as people know what to expect from the others. By learning the same standards during the training period, misunderstandings in communication, etc. should be decreased.

Training periods and explorations are a good way to fill the gaps of knowledge inside a company. People can feel more integrated to the system because they can act as the others employees do. These periods are also very important for newcomers in a company as they must adapt to the company and quality system. If they do not respect the rules, it will create problems, mistakes, and conflicts between the employees. However, training is also a good way to keep your employee aware and competitive, in a market sense, not internal competition. If you show them how to use the right technologies and latest tools, you can keep them aware about the last market requirements and advancements.

The authors would also like to discuss about a special use of training. A good solution of using training could be to act directly with the end user. In our days, software products are becoming more and more complicated, and that is why the requirements definition is hard to perform. Making a lot of tests and simplify software implies time and money, but this is done to prevent mistake done by the user. Is it true that most of the errors in software only occur when the user is performing an error because of his lack of knowledge in using the software? A utopia vision could be to have the users skilled in using all the software because their producers are training them to use them. If you could avoid some specific and huge documentation just by presenting and training all the companies' employees to use the software, it could be a good solution. It would make the company save money because they do not need to invest a lot of money in applying the new technologies. Just imagine if the users were almost never doing mistakes (e.g. typing the wrong contents for some values, or lack of knowledge in using a certain function in the software). It is true that most of the time, the creators always know where the coding mistakes are. They know perfectly how to

use the software, but as they must do something "easy to use for everybody", they must create more and more facilities, documentation, and it costs a lot. Making a direct creation-training could be a good solution, but it is almost impossible in mass-market project, as too many users would need to be helped. On the other hand, for bespoke projects, it could be more possible to use such a technique.

As discussed above, training is a very important way to improve the employees and the business results. But it is important to note that the training should not be "enforced" inside a company. This term is not correct as enforcing is never a good solution. The top management or a responsible should show why the training is necessary and important to give more efficiency. By this way, people will feel motivated to follow the lectures and participate in the discussion. If there is no commitment to it, the training is useless. It could be a good thing that people want to improve so much that they launch personal researches. This is why the company should provide the tools and help necessary to let their people involve. For example, actions such as buying magazines or books are a good solution to help people that want to gain knowledge. In this case, it is more a personal training, or "learning" that will give benefits to the business results. The good thing in training is that the information can come from everywhere, as long as you apply some source-criticism. If you let your people explain theories or show tools they have discovered, it could give interesting surprises, which in turn could be used to improve the quality system.

Training should be used in the right way inside a company to obtain good results. However, it could also lead to disadvantages that are presented in the next paragraph.

8. General disadvantages of training

The disadvantages of training might be if you try to enforce training. This quality model is build upon that you train your personnel, and with the training they will do the things they are trained for better. But if you try to enforce the training upon them this can lead to lack of commitment and in the worst case to a contra productive environment. With this in mind it is easier to avoid it. The top management should show why they try to improve train the employees, because if they do not, the training can feel enforced and that is never good. Especially when it comes to trying to train anyone, you can only teach people. Learn they have to do themselves.

Another disadvantage is that people tend to over rate the importance of training. This can result in that you think that you have everything solved if you only train your employees. You can train your

employee in almost everything, but some things cannot be trained, and training must not necessarily give an instantly visible benefit. So, how do you know in which areas you should train your employees? First, you have to identify the problems that you want to get rid of, without knowing those; you cannot train your employees to avoid them. This means that you must have some kind of detection system in order to be able to identify the areas in which training is needed. In some cases, something has to occur several times before you can really tell what the actual problem is and what you should do to avoid it. And even if you know it will happen, can training make it go away? Most likely not, you make the impact less significant, but you will still have to try to detect it. You cannot prevent everything, not even everything you know. You can also train your employees in problem solving. For example, the problem if something unexpected happens. You cannot solve the problems for them; they have to do it themselves. However, something you can do is train your employees in the use of different techniques and processes for problem solving.

But when you train your employees, they do not work with their intended work. Instead of working and producing money they cost. Because if they are at a seminar, you will have to pay your employee to be there and you have to pay the one holding the seminar. So by only training your employees you actually lose money. And that means that not every company can afford such an expense. If you want to train within your company, you need skilled people who know what to train and how to train your employees. How much are you going to train your employees? Let us say that you have some problems in almost every area (since you can always improve everything). Then are you going to train your employees in every one of these areas? Then you are going to do nothing else then train them. You have to find what is needed the most and train them in that area, but it is hard to find the one area that is the most troubled.

How do you know that you can train your personnel within your company? You need to create some kind of training department. You need to make sure that everyone who needs and who wants to get training are useful and relevant to them. This is important because if you do not, your personnel will not get the training that is right for them, which in the end is a loss for you as a company as the training that you did give was useless. You have to make sure that there is commitment to the training programmes even in the company's top management, because otherwise they will stay very long, besides the risk that no one else will feel committed if the top management does not care.

Then we come to a very important point. How do you know that your training has improved your productivity or your quality? In software it is all about developing, you never or almost never do exactly the same thing twice, and even if you do, you will have more experience the second time. Therefore, even if you do not actively train your employees the result is going to differ from project to project. Which leads to the question, how do you tell that the differences in efficiency or defects measurements are not only a regular diffraction? This is a problem when you try to measure the result of training. Then the quality, how do you measure an increase in quality? How do you measure quality at all? This means that you cannot tell the top management that your training has given this and that result. You can only guess how the result would have turned out without the training. Then we are back at the commitment problem. How do you secure commitment when you cannot confirm that your investments have given a positive result?

How do you make sure that everyone is trained? Do you enforce that every one should be put in "school" to make sure that you gain the maximum quality or production raise? The problem is that how do you know what is best, enforce all or try to encourage? If you enforce training to all your employees, you have a great potential. But it is hard to enforce training, you can enforce teaching but learning is very hard, if not impossible. The other way is to try to encourage and by a positive atmosphere get everyone to sign up for training voluntarily. This could include having people themselves choosing relevant courses to attend, and just approving them if they seem to actually be relevant. This way has a great potential, because if you choose to let your employees choose for themselves to train and possibly what to train at, they are more likely to do so better than those that are enforced. On the other hand, there is a risk that not as many are going to do the training, because not everyone is interested, at least they do not think they are. When enforced some people might actually get interested when they thought that they were not.

How do you know what to teach your employees? Even if you know what area to train your personnel in, there is so much information that you might not know what to choose.

9. Conclusion

We do not recommend trying to avoid training. As we have mentioned repeatedly in this report training is a very fundamental thing. Just instructing someone in what they are supposed to do could be considered training. We have to conclude that training is a good thing. We recommend that you consider the experiences you have and thus turn

them into learning and use what you have learned when planning and conducting new tasks. We cannot really recommend any specific method in favour of another; it all depends on the situation and should be evaluated for each training course.

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