

Title:**Using 2-D Autocad to facilitate Understanding of Orthographic Projection in Year 9.****Researcher:** Rhoanna Keen and Philip Wilks**Date:** September 2000 to August 2001-07-18**Contact Details:**

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Research topic:

Technology – integrated pedagogical strategies Secondary School Design and Technology teaching and learning.

Geographical Area where research conducted: England – Eastern Region**Educational Sector of Participants:** Secondary**Abstract:**

This small-scale case-study examined how the use of Autocad, a drawing package, was used to support the teaching and understanding of Orthographic Projection at an Upper school level.

The approach used was based on the idea that teacher led activities and resource guides helped students to learn to use the package to draw the Ortho of their wooden box. One group was teacher led and one group the students worked on their own, both groups used the support booklet. The study examined the use of this approach whilst learning Autocad and creating an Ortho of the box. This mini research project was carried out with four year 9 mixed ability Design and Technology groups over a period of six weeks, one lesson a week at the end of the wooden box project. Evidence about the teaching of Autocad and Orthographic Projection during the six lessons was gathered through the students work of the Orthographic being marked and also a questionnaire asking how beneficial they found the lessons. The main findings of the study were that the teacher led group made a higher success of the tasks set than the other groups. However, the teacher led group did not all attain the higher levels as they were taught together. It was felt that next time there needs to be more independent working and collaboration of the teaching of the two groups to get greater success. The booklet was a fantastic aid to teaching the package and helped the students to solve their own problems. This project catered for a wide range of abilities and learning styles which in turn helped to gain greater success for all.

Findings:

The project was analysed and findings found in the four areas, the lessons structures, the Autocad booklet, the task set and the completed questionnaires. The questionnaires helped to clarify the thoughts and observations found by the teachers.

The structures of the lessons, especially the teacher led were good and all students learnt at the same rate, but within set tasks they were still able to go at their own rate but with in limitation. However, it was felt that certain lessons taught in this way did hold up some of the students, this was easily shown by the completed questionnaire answers and the completed task results. This project used a range of teaching styles, group work, individual and teacher lead. This catered too more students and a greater success rate was achieved in all areas evaluated, this was shown in graphs and the questionnaires.

Group work was used to teach Orthographic projection, this was a fantastic way to use peer support and discussion in understanding the concepts. It seemed the students remembered placements of the views and were able to understand the drawings.

Students found the initial booklet very hard to decipher. It was not in order and too wordy to extract the information needed. Although they felt that it was a helpful booklet to refer to. The second edition had less words, and the commands were easy to follow through introducing step by step instructions and were more successful although the steps were incomplete and still needed work done. Edition three went this step further and the commands were in order, were clear and understandable. The students found that they could use them confidently and remember the easy commands. This final booklet (**Appendix B**) uses screen dumps to help with each new command and steps to complete the Orthographic drawing of the box. It was

easy to follow and gave access to all learning types and should therefore show greater success rates from all the students.

The project produced quantitative results from the task set, to complete an Ortho of the box see **Appendix E** for the drawing and **Appendix C** for the collaborative results. The results show that the hand taught group has average results across the middle levels of completion for the views. The group all managed to do some dimensioning and all created three views of the box. The teacher led group had a range of completed views and spread across most levels. However, it is interesting to see that the levels not achieved are the latter ones, i.e. they were teacher lead therefore they all were kept to a pace. The dimensions results are more spread, this was due to the group being initially taught and then allowed to work at their own pace. The non-teacher led group had a diverse range of results, this was expected as the group is mixed ability and allowed to work at their own pace. This helped to show the booklet produced help to teach and lead the students through the tasks independently. They had their own level of success.

The questionnaire results (**Appendix D**) helped to clarify the results found and the views felt by the students. It makes interesting reading.

Participants' Information:

All the student groups used were in Year 9, they are mixed ability groups with a complete range of CAT scores and with a fair number of males and females in each group. Below is the list of the Groups used and their teachers.

GROUP	TEACHER
09ADt	Rhoanna Keen
09BDt	Rhoanna Keen
09CDt	Rhoanna Keen
09DDt	Philip Wilks
09EDt	Philip Wilks

Equipment and materials used: (all of which can be found in the Appendices)

Autocad Drawing Package

Reference booklet: Learning Autocad (**Appendix B**)

Reference sheet: Orthographic Projection of the wooden box (**Appendix E**)

Questionnaire, one teacher led and the other non-teacher led, depending on the groups. (**Appendix D**)

Lesson Structure (**Appendix A**)

Applied method of analysis:

The research project employing multiple sources of evidence as follows:

- Teacher observation of the booklet, lessons and tasks set
- Students success rate on the Ortho of the box and the questionnaires

The first point helps to collaborate any interesting issues found during the project. Through monitoring students progress of the booklet it helps to address major problems and allows amendments to the booklet. Observing the lesson structures and content, it makes sure that the students are getting the best from the lessons, they will be addressed constantly before, during and after each session. During the project it will be essential to discuss issues found between the teachers to help overcome them in future.

The second point needs to be documented as quantitative results to show the success of the work undertaken and learnt by the students. Depending on the work it will determine the students learning and understanding ability of the package taught and the theory learnt.

Conclusion/Discussion:

The structure of lessons were good, they used a variety of learning styles and therefore reached the majority of students in the group. However, it was felt that instead of deciding on one method or the other in regards to teacher led or non-teacher led, both teachers found the best solution would be to incorporate both within the project. Apply each as and when needed during the tasks set within the booklet. This should in theory lead to a greater success rate for all abilities.

It was a great opportunity to use a range of teaching methods to put the theory across. It was felt that this helped to keep the students motivated and eager to learn Autocad and Orthographic projection. From the questionnaires it is easy to see that most enjoyed using the

computer to learn this new information. It helped to stop the segregation of pupils who can draw from those who struggle. It gave access to all and built new strengths and confidence in the subject. The students saw spectacular results with the computer.

From the start the project would have a booklet based teaching aid. However, it was not realised how long it can take to get the book right. It was enlightening to see what the students felt about the booklet. The students felt involved in the project when they were asked their opinions of the booklet and then saw the developments of it. The final booklet worked excellently within this project and the students enjoyed using it. The success of this project relies mainly on the excellence of the booklet. It was evident that students confidence was raised with the booklet as support and it helped teachers to teach the theory in an easier way. The final results of the Ortho were surprisingly good, it was not expected that as many students were going to be as successful as they were. These results confirmed that the non-teacher led groups had higher levels of success, however, not all students achieved these successes, it made the group very dispersed and harder to teach. The teacher led groups on average scored better levels, but none managed the extension tasks. It was felt that the use of non-teacher led activities would help the students to gain better success levels of the completed work.

It was hard to compare a computer package to a hand drawn method of teaching. This is due to the hand drawn group already having a head start on the computer groups for the following reasons. They could already draw using a pencil and a ruler and are teacher led through the drawing step by step. Whereas, the Autocad groups had to first learn how to use the package before they could start to draw the Ortho of the box. This in turn meant that they were taking on a lot of new information very rapidly. Therefore it is a great success to see the results from this project. In this way hand drawn groups should have better results than the other groups, however, they may not be as neat or well presented as the computer groups and this is where the computers have the advantage.

Recommendations:

This project has gone beyond what the team in school were hoping for. The success we have seen in these few lessons with Autocad has been very beneficial to the students and our Schemes of Work throughout the year groups. The booklet produced can easily be modified for use within other year groups. However, for it to be successful as specified earlier it needs to incorporate all elements looked at and use them in appropriate situations. If this approach was to be used in another situation, the most valuable aid is the booklet. Getting this right helped other areas of the project.

To use these methods within any other teaching situation, the essential advice would be: ensure all support aids are well set up and use a variety of teaching styles and methods to help reach all the students.

Further research is still needed into the effectiveness of each method used and when is the pinnacle point where it starts to become not as effective in learning new theories.

Research evaluation:

Although this project has been a success within our school. It meets all the elements set out at the beginning and within our department for year 9 Scheme of Work. It may not be beneficial or have the same kind of success in other situations. The major thing that has come out of this for school is that the department now has a great Autocad project and support book for teaching the package to all year groups.

This project has helped my own professional development as I am now confident to keep trying new projects and be able to evaluate them effectively. Already this project has been revamped and incorporated within the year 9 Scheme of Work.