

# CaRE in Schools Handbook

Project: CaRE – developing collaborative and reflective environments in schools

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## Introduction

Many dedicated teachers appreciate a climate of cooperation for joint development of teaching. Anyone who visits "good schools" quickly notices this as a common feature of all these schools, in addition to their respective pedagogical specificity. Indeed, no lasting pedagogical innovation would be conceivable without a strong capacity for collaboration among the faculty. It is not so much the originality of the pedagogical ideas, but the consistency of the joint implementation of these ideas that is surprising and convincing.

Teacher collaboration is considered an essential prerequisite for successful teacher development. However, teachers still tend to be seen as "lone wolves", and a lack of readiness for development in institutions is often cited as a hurdle to joint instructional development. The lack of willingness to open the classroom and to organize teaching work cooperatively can be due to a number of factors. First and foremost is certainly the fact that the teacher stands alone in front of the class and may be uneasy at the prospect of welcoming another educator into this space, for fear of judgement. Secondly, there are several structural conditions that can prevent, or make it difficult to, establish genuine teamwork within schools. For example, there is often a lack of suitable locations, limited time within a packed timetable, insufficient guidance for building teamwork (Pädagogik 1/2010).

Cooperation and collaboration in a school can be implemented in very different forms. This handbook provides description of four practices that we see as underpinning CaRE (collaborative and reflective environments) in schools, and summarizes the experiences of the consortium's partner schools in each of these areas.

## But what is CaRE in Schools?

It is common practice for teachers to work alone with their students, without engaging in many collaborative practices with their colleagues. While the necessity to prepare young people for full participation in a rapidly changing society has been noted by educational policy makers at an international level, leading to increased emphasis on the development of students' key skills and competences, this is not often reflected in teacher professional development and the corresponding development of their own key skills.



There is a significant body of research that points to the need for methods of teaching and learning that are innovative, competence-based and student-centered, but despite moves to change the curricular focus, a traditional model of schooling is still prevalent in many countries. Teachers are the agents of change in the reform process but can resist change unless they understand and agree with the reasoning behind a reform, its implications for their classroom practice, and consequences for their students. We believe that the best way to achieve this is by supporting teachers' development of their own key skills through engaging in collaborative and reflective practices, thereby building their understanding of the relevance, benefits and importance of the key skills in their own day-to-day experience.

Therefore, a primary objective of this project is to support and enhance the development of collaborative and reflective environments (CaRE) in schools. Through this project, we aim to mirror the development of key skills and competences that are generally advocated for students, within the whole-school environment by encouraging teachers to work increasingly collaboratively.

In this handbook we aim to present a suite of practices that can be used to support teachers to come together to communicate and share good practice and creative approaches, and to critically evaluate and reflect. Through our own collaboration and discussion, we have identified four practices that we believe support teachers to engage in collaboration and reflection. These are:

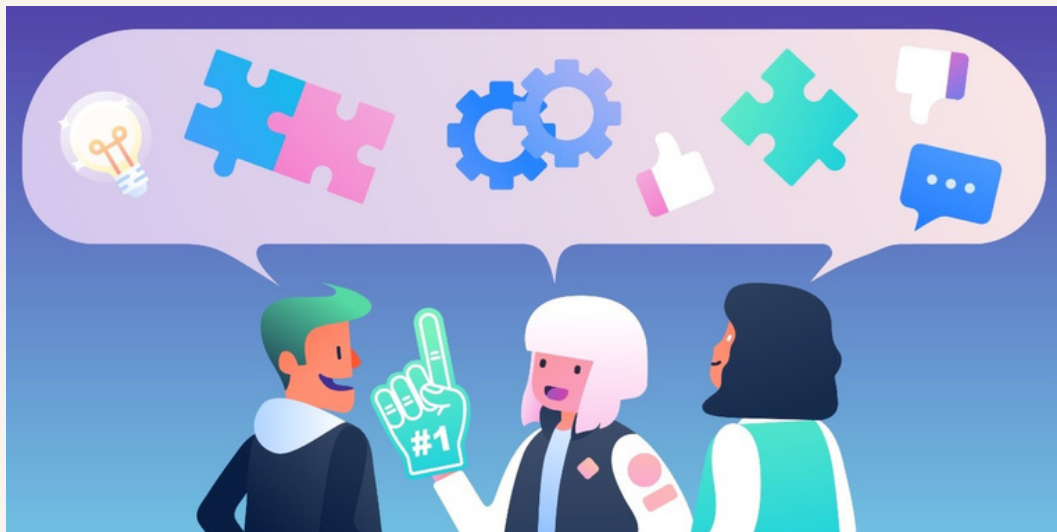
1. Collaborative planning (or co-planning)
2. Team teaching (or co-teaching)
3. Peer observation
4. TeachMeets

Through this handbook we will provide an overview of each of these practices, drawn from a systematic review of relevant research. This will be followed with practical guides outlining what each of the practices entails and how they can be incorporated in different contexts. A series of case studies from each of the project partners will illustrate how they incorporated these practices into their own CaRE environments.

It is important to note that all of the practices described below should include a collaborative reflection stage; this is essential for learning and for growth but is something that frequently takes place in isolation, or not at all.



## Collaborative planning/Co-planning



### What?

Co-planning is generally understood as the practice of two, or more, professionals collaboratively planning instruction for a group of learners. It occurs when teachers discuss and develop lessons and/or assessments collaboratively. When co-planning, teachers actively and collaboratively plan by sharing ideas, developing draft plans for feedback, sharing resources. Depending on their focus, they may also review assessment data, make decisions for grouping students, design tiered assignments etc. Co-planning may occur in person or virtually (e.g., using MS Teams, OneNote, Google Classroom, Google Docs etc.). It may lead to co-teaching, but this is not necessarily the case.

Mofield (2020) suggests that co-planning may take place between two educators, or within larger professional learning communities or communities of practice. There are numerous models of co-planning that are appropriate in different contexts:

1. Co-planning can involve teachers of diverse specialisations collaborating to create cross-curricular or interdisciplinary learning experiences.
2. General education teachers can collaborate with special education teachers to collaboratively develop differentiated instruction.
3. Teachers within the same discipline can plan together in order to develop and share best practice.



## Why?

“When teachers work together on teams to coordinate and integrate instruction, teaching and learning outcomes improve” (Senn, 2019).

Given the various models of co-planning, it makes sense that there are numerous reasons for why this might be a good approach depending on the context.

- According to Senn, McMurtrie, and Coleman (2019), cross-curricular co-planning will support teachers to move beyond their own subject areas, providing opportunities to make the curriculum more relevant to the learners. In this way, the learning that takes place will be more reflective of the real world, rather than remaining siloed in subject domains, with students using whatever knowledge and skills the situation requires to solve problems and address the situation. A good example of this would be a task that combines mathematics, geography and science, through which the students would be enabled to see mathematics as more than just numbers, but as having meaning that can impact real-world outcomes such as climate change.
- When general education teachers plan with special education teachers, they can support each other to focus on the needs of the whole class. This has the potential to make mixed ability teaching more effective by ensuring that the teaching and learning works for the full range of students. Strategies such as differentiated instruction (Tomlinson et al., 2003) and/or universal design for learning (Ok, Rao, Bryant, & McDougall, 2017) should underpin planning in this context.
- Co-planning within subjects is likely to happen to at a high level within most subject departments. However, the targeted collaborative planning of individual lessons can benefit teachers by allowing them to share and reflect on each other’s expertise. Specific strategies such as Lesson Study (Takahashi & Yoshida, 2004) can be used to structure a process of co-planning, with other, less formal approaches also beneficial.

## How?

While co-planning can occur informally, it is generally more effective when supported by appropriate professional development.

For cross-curricular co-planning, Senn et al. (2019) suggest that the grade/age/year-level teaching teams are brought together, comprising of “one teacher from each of the four main content areas: English/language arts, mathematics, science and social studies,” with at least one teacher from a discipline outside of this group. The teams should collaborate to develop cross-curricular lessons that target a minimum of three of the content areas. This approach should result in an overarching plan for the unit as well as lesson plans and resources required to facilitate the delivery of the unit to the learners. Ideally, these plans and resources should be shared with other teachers, both internally and external to the school.

# Co-teaching

## What?

Villa, Thousand, and Nevin (2008) define co-teaching as “two or more people sharing responsibility for teaching all of the students assigned to a classroom” (p. 4). This approach to teaching requires significant coordination of instructional practice, with much time spent on shared responsibilities of planning and reflection (Hurd & Weilbacher, 2017).

There are a number of different models of co-teaching, which can lead to some confusion when using the terminology! In this section we will explore four co-teaching models, all of which have the primary goal of supporting the diverse academic and social-emotional needs of all students in the class. In each case, the teacher team may be made up of two general education teachers, two special education teachers, or one of each, or, in some cases, it may be a teacher and a classroom assistant working together. In general, it is expected that co-teaching will have a foundation in one of the co-planning models discussed above.

- **Team teaching** is one model under the umbrella of co-teaching. This method is most often used in settings where general education in a particular subject is blended with special education, to benefit students with diverse needs in a classroom. When team teaching, both of the teachers contribute to the direct teaching, and they move about the room as needed to support the students. In this way, both of the teachers have an equal instructional role, and the students are exposed to diverse, but complementary personalities and teaching styles, with both teachers taking turns presenting information to the group of students (Keeley, 2015).



- With **station teaching**, the classroom is set up with multiple learning centres or stations. The class is split into three or more groups that rotate around these stations. As the students move around the room the teachers manning each station should teach the same content, but in different ways, or related content that builds and strengthens students' understanding. It can be beneficial to have some student-led stations, with at least one focused on independent work or practice opportunities.
- **Alternative** or **Differentiated Teaching** groups students according to their learning needs, with one teacher instructing most of the class and the other teaching a modified version of the content to a smaller group. In order to successfully engage in this kind of co-teaching, it is essential that the instructors have a strong understanding of the student data in the class. In this way it is possible to identify any students who need support filling in gaps in background knowledge, or need remediation, or which students already know the content or have mastered the skills and would benefit from accelerated learning content.
- The **One Teach, One Assist** method of co-teaching involves one teacher taking responsibility for the whole-group instruction, while the other offers support to individual students.

More detail on each of these models of **co-teaching** can be found in Hurd and Weilbacher (2017) and in Keeley (2015).

## Why?

Ó'Murchú and Conway (2017) note the positive effects of co-teaching in the context of facilitating mixed-ability classrooms especially when there are students with diverse needs or learning styles within a classroom. Increasing the ratio of teachers to students in a classroom means that more personalised attention can be given to students where needed. Having two teachers in the room can reduce the need for students with additional needs to be withdrawn from class for support, thereby leading to a reduced emphasis on labels and labelling. In this way, the classroom is more likely to become a community of learners and learning.

Tangible benefits of co-teaching have been widely reported, including gains for reading scores, decreases in absences and fewer referrals for students with disabilities. Teachers may be beneficiaries too, in terms of improved professional relationships and support, and re-energisation of their practice. Kodkanon, Pinit, and Murphy (2018) note the "positive impact on student learning outcomes," as well as increased student participation and opportunities for student-teacher interaction. The authors also highlight how co-teaching practices can serve as a form of professional development, and results in a more positive school climate and job satisfaction, with teachers noting that they were empowered to try things they would never have tried on their own.



## How?

Co-teaching has obvious benefits, but it can be challenging to implement. Professional development that focuses on effective co-teaching is very important to ensure its success. This practice works best when school management and administration is supportive and involved, ensuring that appropriate training and adequate planning time are allocated to the teachers. Co-teaching tends to be most successful when the following conditions are met:

- Teachers **volunteer**, rather than are compelled, to participate.
- Open channels of **communication** are maintained, providing a safe space to respectfully raise any concerns that may arise. Teachers need to be comfortable with taking others' suggestions and experience into account when planning their lessons, and should be willing to adapt their material to best suit the students in their classroom.
- **Time** is invested into the practice, which can be challenging for teachers. Co-teaching requires planning time as well as the time given to delivery of lessons.
- Co-teachers must set aside time to *collaboratively plan and reflect* on the lessons.
- Co-teachers should work together to understand the needs and accommodations of all the students in the class. According to Mastropieri et al. (2005) co-teaching is most successful when co-teachers use a clear and agreed structure, display enthusiasm, and collaborate to maximise student engagement.
- Co-teachers should plan who is doing what. Regardless of the co-teaching model, it is essential that the responsibilities of each teacher are carefully thought out.
- Time should be set aside to agree on a set of expectations for students, behavior, homework, etc. This allows co-teachers to identify and work out any differences they may have, and come to a consensus for how to run the shared class. Behavior management should be shared equally and fairly, without resorting to a "good cop/bad cop" scenario.
- Students should be able to easily recognise the co-teachers as a team; both teachers' names should be equally evident in relation to the class and on assignments etc.
- When teachers are collaborating across disciplines, a project-based learning approach can be helpful, in order to integrate the content areas.

## Peer observation

### What

Observation of practice, as a vehicle for professional learning, has garnered a significant amount of attention in recent years. It is commonly practiced in many highly effective US schools, and is seen by some as a method for reducing the isolating nature of traditional schooling (Visone, 2020). Gosling (2002) presents a classification of peer observation models, which he terms 'evaluative', 'developmental' or 'collaborative'.

**Table 1: Models of Peer Observation of Teaching (adapted from Gosling, 2002)**

<p><b>Characteristic</b></p> <p>Who does it &amp; to whom?</p> <p><b>Purpose of Observation</b></p> <p>Outcome/output</p> <p>Relationship of observer to observed</p> <p><b>What is observed?</b></p> <p>Who benefits</p> <p>Risks</p>	<p><b>Evaluative</b></p> <p>Senior staff observe other staff Performance</p> <p><b>Evaluation, probation,</b></p> <p>prom Report or judgement</p> <p>Power</p> <p><b>Teaching performance</b></p> <p>Institution</p> <p>Alienation, lack of cooperation, opposition</p>
<p><b>Characteristic</b></p> <p>Who does it &amp; to whom?</p> <p><b>Purpose of Observation</b></p> <p>Outcome/output</p> <p>Relationship of observer to observed</p> <p><b>What is observed?</b></p> <p>Who benefits</p> <p>Risks</p>	<p><b>Collaborative</b></p> <p>Teachers observe each other</p> <p><b>Promote discussion about teaching; self and peer reflection.</b></p> <p>Non-judgmental, constructive feedback; analysis and discussion; wider experience of teaching methods</p> <p>Equal</p> <p><b>Teaching performance, classroom management, learning materials</b></p> <p>Mutual between peers</p> <p>Complacency, conservatism</p>
<p><b>Characteristic</b></p> <p>Who does it &amp; to whom?</p> <p><b>Purpose of Observation</b></p> <p>Outcome/output</p> <p>Relationship of observer to observed</p> <p><b>What is observed?</b></p> <p>Who benefits</p> <p>Risks</p>	<p><b>Developmental</b></p> <p>Teacher educators or expert teachers observe newly qualified or student teachers</p> <p><b>Demonstrate or improve teaching competencies; assessment of practice</b></p> <p>Report and action plan; pass/fail</p> <p>Expertise</p> <p><b>Teaching performance, classroom management, learning materials</b></p> <p>The observed</p> <p>No shared ownership, lack of impact</p>

For the purposes of this handbook, we will be focusing on the collaborative model of peer observation, but even within this category, there are various models evident in the literature.

Perhaps the simplest model involves teachers visiting the classrooms of their peers, followed by non-evaluative debriefing sessions that include both the visiting and host teachers. Other models include a “rounds model”, involving small teams of educators who circulate around the school with a specific focus specific, dropping into classrooms for short periods of time (Hunzicker et al., 2017). An emerging model involves the use of video for classroom observation (Liang, 2015), which removes the need to coordinate teachers to be in one place at the same time, but introduces complexity in relation to privacy. Indeed, each of these methods has benefits and drawbacks, which need to be taken into consideration when selecting the model most appropriate to a given setting. Further information on these and other methods of classroom observation, can be found here: <https://www.aitsl.edu.au/lead-develop/develop-others/classroom-observation/classroom-observation-strategies>.

### Why?

Research evidence indicates that peer observation has great potential to increase collaboration between staff, particularly when it is embedded within a community of practice. For many teachers, the intention to participate in peer observation is linked to the belief that it will lead to an improvement of their own reflective practice and their teaching, and to the overall sense of collegiality in the school.



## How?

As noted by Aubusson, Ewing, and Hoban (2012), there can be a culture of resistance to collegial sharing in schools, with teachers working in silos, and the structures within the school can hinder this kind of cooperation. Therefore, the primary issues that need to be addressed in order to encourage teachers to consider peer observation relate to anxiety or discomfort that teachers may feel about being observed, and structural issues such as timetabling and other time constraints.

To increase uptake of this kind of practice, and to overcome opposition or resistance, schools need to demonstrate to teaching staff that this model of peer observation is aimed at **professional development** and not at judging or critiquing teachers. Sandt (2012) notes that it is essential to establish a climate **of trust and openness**, such as within a community of practice, if peer observation is to be successful.

Peer observation is generally most successful when it takes the form of a **structured** observation with a clear set of foci and procedures. This can be organised at the level of individual teachers, but it is likely to be more successful if it has a clear organisation and structure, which frequently benefits from support and direction from administration, or a focused community of practice. According to Motallebzadeh, Hosseinnia, and Domskey (2017), the procedures adopted should provide teachers with as much **autonomy** as possible: the observed should be allowed to choose their observers, decide which aspects of their classroom behaviours or activities should be in focus, and decide on any action to be taken following the observation.

For this kind of peer observation to be successful, feedback should be **formative**, rather than evaluative, providing descriptions rather than judgment. In order to ensure that participating teachers are at ease, it is very important that the school management remain as unobtrusive as possible, even if they initiated the exercise.

In addition to the practical side of things relation to timetables and structures, the role of the administration can be to provide supportive activities such as workshops, in which the participants can clarify the objectives of the exercise and explore the procedures involved.



# TeachMeets

## What?

A TeachMeet (TM) can be viewed as a form of informal Continuing Professional Development (CPD). It has been described as “guerrilla CPD, unconference, and bottom-up CPD” (Basnett, 2021, p. 139). The TeachMeet originated in 2006 in Scotland (McIntosh, 2006), and is a participant-driven gathering of educators sharing practice. The by-line for a TM is “teachers sharing ideas with teachers”. As this suggests, the presenters at a TM are also the attendees; they are there to learn from each other at a utilitarian meeting. The TM format is based on Open Space Technology (Owen, 2008), in which the ‘one law’ is the ‘law of mobility’ - a tacit permission to move about during the meeting. The presentations are short, often described as micro or nano presentations, and there is ‘break-out time’ allowing participants to learn from each other and share and develop ideas. Indeed, according to Bennett (2012) the TeachMeet capitalises on the value of a conference that does not come from the keynotes, seminars or workshops, “but the conversations that happen in the corridor or over coffee” (p. 24).

TeachMeets often have a facilitator who organises the timings and, if there is one, the theme of the meeting. Many TeachMeets however also do not adhere to a single theme, and instead have significant variety in the presentations depending on who volunteers to present (Amond, Johnston, & Millwood, 2018).

## Why?

### ***“I Came Out Buzzing - It Changed How I Thought About Teaching”***

Basnett (2021) notes a variety of benefits for teachers engaging in TeachMeets.

1. The variety of topics discussed gives participants new ideas and introduces them to different pedagogies. Participants gain real resources and strategies that can immediately be applied to their own teaching context
2. The brief presentations and encounters at a TeachMeet act as a spark to ignite or inspire a passion. This has been termed ‘spreagadh’ – an Irish word that translates as ‘urging, incitement; incentive, encouragement; excitation, stimulus’ (Teanglann.ie). Participants at TMs have reported benefits ranging from a short term ‘fix’ to long term transformation: “one little spark of inspiration that can keep you going for the rest of the term” (Interview excerpt).
3. If a TeachMeet is away from school, then it gives educators the chance to look outside the ‘way of thinking’ within their organisation.
4. It gives a chance to glimpse inside the ‘black box’ of another teacher’s classroom, “giving a platform to teachers to share work in progress, not finished polished stuff, ideas about what’s actually going on in their classroom” (Interview excerpt).

5. Opportunity to informally collaborate with and learn from like-minded educators and to build community and learning networks with others “it’s not just about who’s in front of you... it’s who’s sitting beside you” (Interview excerpt).

6. Sharing by modelling. Seeing someone else describe or demonstrate what they do, and learning from that, is appreciated as a generous gift to others at the TeachMeet, and is valued on several levels, from the effect it has had on seasoned teachers to the potential it has for future teachers.

## How?

### *‘No Keynote, Everybody Is Equal, Everybody’s Voice Is Recognized’*

It is important for TeachMeets to have a facilitator, rather than a leader (Bennett, 2012). The role of the facilitator is to make people feel welcome and comfortable, and to encourage participation. There is a need for a time limit for each of the short presentations and for any breakout sessions, and it is good to have the opportunity for socialising afterwards.

If the TeachMeet is in a physical space and not online, the room itself should be conducive to putting people at ease. The use of round tables for example, can help to create an atmosphere in which people feel they are safe to contribute. Regardless of the space (in-person or online) It is essential to create a judgment-free culture, recognising that participants are all colleagues who were there to learn, and who are there to support each other: “it’s a place where you will be made feel comfortable, and there’s no such thing as stupid questions” (Interview excerpt).

Another essential element to a TeachMeet is the mix of participants. There should be variety in terms of the career experience of those participating; the range of schools represented in the room; the variety of content and method in the presentations; the positions of authority or influence of those attending.

The mindset of those facilitating and participating in a TeachMeet is of great importance. According to Bennett (2012) “in particular, the facilitators need to value looking irreverently at what teachers do and to challenge existing ways of thinking” (p. 26). The great value of a TeachMeet is that the everyone involved is equally interested in the learning process, regardless of their experience, background or interests. In essence, the most important ingredient is teachers that care enough about teaching to give up time to talk about it.



## CaRE in our Schools – the Case Studies

### Collaboration of Teachers within the Same Subject

In St. Dominic's Secondary School (Ireland) there are assigned times at the beginning of each year for subject meetings. Time and space are given for teachers to discuss targets and plan for the term ahead. Each subject has shared folders with schemes of work, plans and other resources. Each teacher has an online classroom to share resources. There are roles within the group. Members are part of outside associations to feed relevant information. Middle management have different roles that they try to include and share ideas with other members of staff.

Portlaoise College (Ireland) has a similar structure of cooperation: Through department meetings all teachers in a certain subject will meet and collaborate regularly. For example, the Irish teachers will meet regularly to discuss class tests and how to implement targets of the curriculum.

At Powiatowe Centrum Kształcenia Zawodowego i Ustawicznego w Wieliczce (Poland) the subject groups and teams of teachers are divided into general subject groups and vocational subject groups.

Each group has a team leader who is responsible to the headmaster, and he/she holds the team meetings regarding current matters. The subject teams meet every month or every 2 months to exchange experiences, ideas, new materials, discuss latest problems and find common solutions. The team members also communicate with one another daily.

In Austria at BG/BRG Schwechat, the organization of the cooperation of teachers of the same subject is similar to the structure described in the school in Poland. Teachers cooperate in teams of teachers teaching the same subject with one leader of the working group who reports the results of the meetings to the headmaster. In the language subjects, the teachers work together very intensively, they prepare lessons, homework and tests together. There are also teams of teachers who are creating moodle courses for students as teamwork. In the same subjects there are moodle courses for teachers sharing content and didactic concepts.

Colegio Santa Elena (Spain) organizes the cooperation as follows: In the Primary stage, the collaboration between teachers of the same group of subjects could be improved. In many situations teachers have too little time to organize good communication. The school has meetings scheduled, but not specifically for teachers of the same subjects. For example, language teachers have no meetings to discuss cooperation.

In secondary school the collaboration between teachers of the same subjects is better because they have specific meetings for cooperation.

In the secondary school the communication of teachers is better organized because there are meetings of teachers teaching the same subject. The collaboration between teachers of the same group of subjects can be improved. In many situations, because we do not have enough time to communicate. We have meetings scheduled, but not specifically for teachers of the same subjects. The meetings are usually of tutors and specialists, of the stage in general.... But we do not have meetings of language teachers, for example.





# Interdisciplinary Collaboration of Teachers using the Example “Interface Technology and Design”

## Interface/TuD1

A TuD (Technology and Design) focus with multi-perspective learning and modern technologies for innovative education, beyond the disciplinary boundaries. The BG/BRG Schwechat is currently working on the development and implementation of a concept which should position the school subject TuD (Technology and Design) as an interface for practical teaching. The aim is to network various subjects through practical work.

In this way, students are to be made aware of connections and contexts. A transformation from knowledge to know-how will take place through practical work.

Subject-linking, action-oriented teaching can be the basis for recognizing content-methodological connections. Innovative, interest-based lessons with everyday relevance to promote natural science, technology and humanities subjects as well as art. TuD acts as the interface of all these fields. It includes artistic, technical, scientific or didactic theory and practice. It establishes references and creates connections and contexts. The aim is to process abstract content in a diverse and action-oriented manner, to open up trial and experimental fields and to lay the foundation for future inventors.

### **Focus on TuD, benefit for all subjects.**

1. The didactic background is provided by the STEAM concept, which expands the subjects Science, Technology, Engineering and Mathematics with "Arts". "Art" in this context is to be understood as humanities as well as art (applied and fine). The central didactic element is interdisciplinary teaching. This should enable a multi-perspective discussion and thus promote networked thinking and contextualization. Pupils should understand how content is related and why it is relevant to them.

STEAM also specifically promotes pupils who are often not addressed by classic STEM education concepts.

2. For example when they are taught in after school or summer camp courses. So special classes like “elective subjects” or “optional exercises” can only be one step on the road to integrate STEAM in the regular curriculum (cf. Quigley and Herro, 2019, p 1)

3. A general strengthening and repositioning of the subject TuD should create opportunities and conditions to enable practical, subject-related teaching.

4. An essential step in this direction and thus a main aspect of the overall project is the establishment of a workshop for digital production techniques and the implementation of these technologies in the TuD lessons and beyond. Analogue-digital interfaces should be created and pupils should be given access to modern technology. 3D printing or laser cutting, vinyl cutting, coding and robotics,... expand the range of techniques and, thanks to the range of options, also the opportunities for cooperation with other subjects. Therefore, the integration of those technologies into the existing workshops is key. There should not be a clean makerspace, but the competence of the TuD-teachers should be used to choose and handle the best technology for the individual project.

### **Model-class 3AR**

The 3AR model-class is currently testing the desired interdisciplinary teaching concept with various projects. Due to the active role of the students in the form of project work, they are not passive test objects for a school concept, but help to develop it. The inclusion of students/pupils in the design of their learning structures and working situations is a crucial point in the democratization of schools.

Digital manufacturing technologies should be used more frequently and in the connection between computer science/physics/geometric drawing and TuD, but also other cultural studies subjects, they should ensure more understanding of the content across the disciplinary boundaries.

Pilot projects from the class 3AR within the school year 2021/22

\*Getting to know the digital workshop (TuD and media presentation):

Production of Christmas tree decorations with 3D printing and laser-cutting and production of a Christmas video for the school website as a digital alternative to the canceled physical Christmas party. The mini-project represented a first, low-threshold introduction to 3D printing and laser cutting for the 3AR. They got a first glimpse of the new sub-area of the workshop and its equipment and also presented the interface/TuD with the video produced by the school.

Basic aerodynamic and physical requirements for flying objects were developed in physics lessons. Also basic principles of experimentation and logging were taught. TuD discussed the role of design and physical principles on the function of rockets, rockets were made, categorized, systematized, and catalogued. A launch station and protractor were built. The flight experiment took place at the sports field. Two distances to the launch station were set, the cataloged rockets were fired and the angle at the highest point of the trajectory was read and noted using a protractor.

The actual flight altitudes were determined in physics lessons by means of triangulation. The students received a "Rocket Science" trophy for the successful completion of the project. In addition to the great joy and the evident interest of the students during the project, the findings on optimizing the experiment during the practical work were particularly impressive. Theoretical considerations and sources of error were independently recognized by the students and modified as much as possible.

These graphics should be optimized for the production of screen-printing templates and screen exposures. Then 3 particularly suitable graphics were selected, exposed on screens and then printed on jersey fabric. From these printed fabrics, simple body shells such as scarfs or more performative objects were sewn to camouflage one's own body, or to perceive oneself and/or others. The importance of camouflage, public image and visibility in society was discussed.

As a result of this project, the students wanted to print their own motifs as well. We therefore decided to draw stencil templates and cut them out of foil with the laser cutter. With this way of working, in contrast to screen exposure, we were able to find a more individual solution for motifs. The students realized that different screen printing techniques are used depending on the motif and the intended use (series or single print).



## **Design and construction of a garden hut for the school community (TuD with art education)**

The aim is to design and build a garden hut for the school together. Building large and non-model objects poses a particular challenge for pupils and teachers. Working together on an object that benefits the school community also strengthens cohesion and is interesting in terms of group dynamics.

In the first phase, the purpose and use of the hut should and can be determined. What is it supposed to be used for? In a second phase, general and detailed designs are made in art classes. The various concepts are discussed and debated in the plenary session. On this basis, a joint design is to be made and a model built. In the third phase, the implementation is planned, production plans are drawn up and material is purchased. In phase 4 all elements are manufactured in the workshop and phase 5 represents the assembly on site in the schoolyard.

After completion of the project, it is handed over to the school community and the project is documented.

## **Basics of leather processing - leather and laser / craft and high-tech : Making a leather belt using traditional and modern technologies.**

The aim of the project is to combine textile and technical content and their manufacturing processes. Content areas such as fashion or body formation are processed with tools that naturally reveal a connection between the two areas textiles and technology. This connection is supplemented in terms of textile technology with modern, digital technology, a laser cutter. Traditional craftsmanship meets digital manufacturing technology.

This project represents the innovative strength that lies in the subject TuD and at the same time how decisive technology, design and handcraft was and is for the development of innovation in history.

## **Geodesic domes, mathematical basis and model building with 3D printing kit and model development. (TuD and mathematics)**

Geodesic domes are both a mathematically interesting subject and an interesting design and crafting task. In mathematics lessons, the theoretical foundations for such structures are discussed, while in handicraft lessons, models of various load-bearing systems and other geometric bodies are produced using 3D-printed plug-in systems.

After working with the finished plug-in system made of 3D printed parts, pupils should work on their own modular system for 3D objects. Technology, material and scale are freely chosen in this last project, so that actual project teaching can take place. The project will conclude with a presentation of the results and work process.

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