SMART LESSON Calculating Heating and Cooling Load of Rooms

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Smart Lesson Structure

MAIN DATA OF THE LESSON	
Title:	*Calculating Heating and Cooling Load of Rooms*
Subject:	*STEM*
Specific topic:	*Physics or Environmental Science*
Main target:	€ *Grade 3 (upper secondary school, age 18)*
Duration:	*4 hours*
Context:	€ *Inside the classroom*
School/Author:	*Panagiotis PAPADOPOULOS, ICT teacher, Gymnasium and L.T. Kallithea Elassonas*

LEARNING OUTCOMES *Specificy the technical competences, digital and life long learning competences which will be developed*	
Key Competences:	*<u>According to 8 Eu Life long learning Competences*:</u> ○ *Mathematical, science, technology and engineering* ○ *Personal, social and learning to learn* ○ *Citizenship* **The digital competence is not listed below as it is already included in the previous point*
Digital Competences:	*<u>According to the DigiComp:</u> ○ Information & data literacy* ○ *Communication & collaboration* ○ *Problem Solving*
Technical Competences:	

DIGITAL TOOLS/APPS	
APPs and other IT tools	*(Brief description of the apps and of the skills/competences that are developed through each specific app)* *App description* ● Google calendar and keep as a project management tool. ● Smart Distance App: A smartphone app for measuring distances and dimensions using the device's camera and sensors. ● Bluon HVAC. An app to accurately calculate the maximum heating and cooling loads for residential and commercial buildings. ● Google Sheets: Collaborative tool for data entry and calculations. ● Google Docs is a cloud-based document editing and collaboration platform. It allows users to create, edit, and

store documents online, facilitating real-time collaboration and sharing among multiple users.

- Search Engines (e.g., Google): To gather information related to heating and cooling load calculations.
- Kahoot: For assessment purposes, evaluating students' understanding of the concepts.

Skills and competencies developed through the apps

. Smart Distance App:

- Mathematical, science, technology, and engineering: Utilizing smartphone sensors and camera for measurements.
- Personal, social, and learning to learn: Learning to use new technology for practical tasks.
- Problem Solving: Solving spatial measurement challenges using digital tools.

II. Bluon HVAC:

- Mathematical, science, technology, and engineering: Calculating heating and cooling loads for buildings.
- Problem Solving: Addressing complex HVAC system challenges with accurate calculations.
- Information & data literacy: Understanding and interpreting HVAC-related data for optimization.

III. Google Sheets:

- Mathematical, science, technology, and engineering: Performing calculations and data analysis.
- Communication & collaboration: Collaborating in real-time on data entry and analysis with others.
- Problem Solving: Structuring and organizing data effectively for decision-making.

IV. Google Docs:

- Communication & collaboration: Collaborative document editing and sharing for project work.
- Personal, social, and learning to learn: Learning to use cloud-based tools for document management.
- Citizenship: Understanding digital etiquette and collaboration norms.

V. Search Engines (e.g., Google):

- Information & data literacy: Gathering and evaluating information relevant to heating and cooling load calculations.

	➢ Problem Solving: Finding solutions and answers to specific queries through effective search strategies. VI. Kahoot: ➢ Personal, social, and learning to learn: Engaging in interactive quizzes to assess understanding. ➢ Communication & collaboration: Participating in group assessments and discussions. ➢ Problem Solving: Analyzing quiz questions and selecting correct answers based on knowledge. VII. Google Calendar and Keep: ➢ Personal, social, and learning to learn: Managing project timelines and tasks effectively. ➢ Communication & collaboration: Sharing schedules and task lists with project team members. ➢ Problem Solving: Organizing and prioritizing tasks to meet project deadlines.

DESIGN OF FHE SMART LESSON IN 4 STEPS	
Step 1 – eTASK **Introduction to the digital task**	*(Introduction to the topic, explanation of the different learning outcomes, general introduction to the activities to be carried out: this is a brief introduction to present the topic and the activities to the students)* ○ ***Topic Introduction**: (A brief introduction to the subject matter, emphasizing the importance of digital skills.)* *Real life problem: In order to optimize energy consumption and improve environmental sustainability, we need an efficient method to calculate the heating and cooling load of different rooms in a building to understand the principles behind heating and cooling load calculations.* *The primary emphasis lies in comparing traditional approaches for calculating heating and cooling loads with contemporary digital solutions accessible through mobile applications.* ○ ***Learning Outcomes Explanation**: (Explain how using these apps will contribute to achieving the specified learning outcomes.)* . Learning Outcomes:

- Mathematical, Science, Technology, and Engineering: Develop proficiency in utilizing mathematical formulas and scientific principles to calculate heating and cooling loads.
- Personal, Social, and Learning to Learn: Acquire new technological skills and adapt to digital tools for practical applications in building design.
- Citizenship: Understand the importance of energy efficiency in mitigating environmental impact and contributing to sustainable development.
- Information & Data Literacy: Gather, evaluate, and interpret data relevant to heating and cooling load calculations, utilizing search engines and collaborative tools. Use of smart apps to conduct measurements.
- Communication & Collaboration: Engage in real-time collaboration with peers through document editing platforms and project management tools.
- Problem Solving: Address complex challenges related to HVAC system optimization and energy efficiency through critical thinking and analytical skills.

- ***Activity Overview:*** *(Outline the main activities, including research, organization, and assessment tasks.)*
  - Pre-Assessment: Before delving into the activities, we'll conduct a pre-assessment to gauge current understanding of energy efficiency concepts and building design principles. This will help us tailor our learning activities to their needs.
  - Exploration of Traditional Methods: We will begin by examining conventional techniques for calculating heating and cooling loads, utilizing reliable sources and established formulas verified through online research.
  - Digital Tools Showcase: Next, we will explore a range of mobile applications designed for precise measurement and calculation of heating and cooling loads, such as Smart Distance App and Bluon HVAC.
  - Data Entry and Analysis: Through collaborative platforms like Google Sheets and Google Docs, we will input data and perform calculations to compare results obtained from traditional methods and digital tools.
  - Information Gathering: Utilizing search engines, we will gather additional information and resources to deepen our understanding of energy efficiency principles and best practices in building design.
  - Interactive Quiz (Pre-Assessment Review): Before moving forward, we'll review key concepts through an interactive

	quiz using Kahoot, allowing to assess students understanding before proceeding to the next phase.
Step 2 – eEXECUTION **Digital execution of the task**	*(Execution of the task, description of the tasks/subtasks that will be carried out with the help of the apps/digital technology)* ○ ***Individual Research and Learning****: (Students use the educational resource app to learn about a specific topic and take notes.)* ➢ Topic Assignment: All students are assigned the task of individually researching and learning how to calculate the heating and cooling loads of buildings. ➢ Utilizing Educational Resource Apps: Students access educational resource apps such as Bluon HVAC, Google Docs, or online tutorials to acquire information on the methodologies and formulas used in calculating heating and cooling loads. ➢ Note-Taking: Using the app's note-taking features, students record key concepts, equations, and examples relevant to calculating heating and cooling loads. ➢ Independent Learning: Each student independently engages with the material, studying calculations for various building types, insulation materials, climate considerations, and HVAC system efficiencies. ➢ Critical Analysis: Students critically analyze the information they gather, evaluating the accuracy and applicability of different calculation methods to real-world scenarios. ➢ Documentation: Throughout the research process, students document their progress and insights within the apps, organizing their notes and calculations for future reference. ○ ***Task Organization****: (Using the project management tool, students plan and organize their learning activities and timelines.)* ➢ Setting Objectives: Students define their learning objectives related to understanding and mastering the calculation of heating and cooling loads for buildings. ➢ Creating Tasks: Using Google Calendar, students break down their learning objectives into manageable tasks, such as researching specific calculation methods, practicing sample problems, and reviewing key concepts.

- Setting Deadlines: Students assign deadlines to each task, considering the overall timeline for completing the project and any external deadlines or class requirements.
- Prioritizing Tasks: Students prioritize tasks based on their importance and urgency, ensuring that critical activities are completed first while also allocating time for review and reflection.
- Collaborative Planning: Students use Google Docs to collaboratively brainstorm ideas, share resources, and discuss strategies for completing tasks efficiently.
- Tracking Progress: Throughout the project, students regularly update their progress on tasks in Google Calendar and Keep, marking completed activities and adjusting timelines as needed.
- Managing Resources: Students utilize Google Docs linked with Keep to store relevant documents, links, and notes, keeping all project-related resources organized and easily accessible.
- Adapting to Changes: If unexpected challenges arise or if additional tasks need to be added, students revise their project plan accordingly, updating deadlines and reallocating time as necessary.
- Reflection and Evaluation: At the conclusion of the project, students reflect on their use of Google Calendar and Keep for task organization, identifying strengths, areas for improvement, and lessons learned for future projects.

- ***At-Home Execution:*** *(Encourage students to engage in these tasks at home, promoting a comfortable and self-paced learning environment.)*
  - Creating a Comfortable Learning Environment: Encourage students to designate a quiet and comfortable space at home where they can focus on their learning tasks without distractions.
  - Self-Paced Learning: Emphasize the importance of self-paced learning, allowing students to progress through the tasks at their own speed and according to their individual learning styles.
  - Utilizing Digital Resources: Encourage students to make use of digital resources such as educational apps, online tutorials, and reference materials to enhance their understanding of heating and cooling load calculations.
  - Scheduling Study Sessions: Encourage students to schedule regular study sessions at home using their preferred project management tool, such as Google Calendar. This helps them

	stay organized and maintain consistency in their learning efforts. ➢ Setting Goals: Encourage students to set specific learning goals for each study session, focusing on mastering particular concepts or completing specific tasks related to heating and cooling load calculations. ➢ Seeking Support: Remind students that support is available if they encounter challenges or have questions while studying at home. Encourage them to reach out to peers, teachers, or online forums for assistance when needed. ➢ Taking Breaks: Encourage students to take regular breaks during their study sessions to prevent burnout and maintain focus. Suggest activities such as stretching, going for a short walk, or engaging in a hobby to recharge their energy. ➢ Reflecting on Progress: Encourage students to reflect on their learning progress regularly, considering what they have accomplished and identifying areas for improvement or further exploration.
Step 3 – eCORRECTION **Digital correction of the task**	*(Describe the different options: self-correction, digital correction with the teacher and with the classroom)* ○ ***Self-Correction**: (Students use digital tools (like grammar checkers or fact-checking websites) to review their work.)* Students,conducting the comparison, can utilize digital tools such as spreadsheet programs with built-in mathematical functions to double-check calculations for accuracy. Additionally, they can use online resources, including reputable websites or databases related to heating and cooling load calculations, to verify assumptions, methodologies, and data used in both traditional and mobile application approaches. For example, if there are discrepancies in the results obtained from traditional methods and mobile applications, students can use fact-checking websites or online forums dedicated to HVAC systems to validate the accuracy of the data inputs and algorithms used by each method. Similarly, if there are uncertainties about the formulas or equations applied in traditional calculations, students can use digital resources like academic papers or specialized websites to cross-reference and ensure correctness. ○ ***Teacher Feedback**: (Teachers provide feedback digitally, focusing on content comprehension and digital skill application.)*

Content Comprehension:
The teacher can provide feedback on the student's understanding of the underlying principles and concepts related to heating and cooling load calculations.
Feedback may include comments on the accuracy and depth of the analysis conducted, as well as the clarity of explanations provided for each method.
Suggestions for further exploration or areas of improvement in understanding the subject matter can also be included.

Digital Skill Application:
Feedback should address how effectively students utilized digital tools and resources to conduct the comparison.
Comments may focus on the proficiency in using spreadsheet programs for calculations, the ability to access and evaluate online resources for data validation, and the overall competency in employing digital tools for academic purposes.
Specific feedback can be provided on the accuracy and reliability of the digital tools utilized, as well as any areas where improvements in digital skills could enhance the analysis.

Overall Evaluation:
The teacher can offer an overall evaluation of the comparison project, highlighting strengths and areas for growth.
Feedback should encourage students to continue developing their content knowledge and digital skills, emphasizing the importance of critical thinking and evidence-based analysis in academic research.
Constructive feedback should be provided to guide students in refining their approaches and methodologies for future projects in similar subject areas.

- ***Classroom Interaction:*** *(Incorporate opportunities for students to share their work with peers digitally, encouraging collaborative learning and peer assessment)*

Online Presentations or Discussion Forums:
Students can create digital presentations or post their findings in online discussion forums dedicated to the topic.
Peers can review and provide feedback on each other's work, offering insights, asking questions, and suggesting alternative perspectives.
Encourage students to engage in constructive dialogue, sharing their thoughts on the strengths and weaknesses of

	different approaches and contributing to a deeper understanding of the subject matter. Collaborative Document Editing: Utilize collaborative document editing platforms like Google Docs, where students can collectively work on a shared document to compile their findings, observations, and analyses. Peers can collaboratively review and edit the document, adding comments, suggestions, and additional insights to enrich the content. This approach fosters teamwork, communication, and the development of collective knowledge among students. Peer Presentations and Feedback Sessions: Organize peer presentations where students showcase their work to their classmates through video conferencing or online presentation tools. After each presentation, facilitate feedback sessions where peers can provide constructive criticism, pose questions, and offer suggestions for improvement. Encourage students to actively listen to their peers' presentations, critically evaluate the content, and provide thoughtful feedback to enhance learning outcomes. Online Polls or Surveys: Conduct online polls or surveys to gather feedback from peers on the effectiveness of different methods and approaches discussed in the comparison project. Students can anonymously share their opinions, preferences, and insights, providing valuable input for further reflection and analysis. Analyze the survey results as a class to identify common themes, trends, and areas of consensus or divergence among peers
Step 4 – eASSESSMENT **Evaluation of the digital task**	*(describe how to measure the achievement of the learning outcomes, evaluate the lesson with regard to the 3 different learning outcomes, optimize the lesson –* *Please, propose some examples of questions for each of the 3 levels)* ○ ***Measuring Learning Outcomes**: (assess if the 3 different types of competences (technical, digital, life-long learning have been achieved)* Technical Competence:

Assessment Example: Students are asked to demonstrate their understanding of technical concepts related to heating and cooling load calculations by accurately explaining the principles behind traditional methods and mobile application-based approaches.
Criteria for Evaluation: The assessment may include evaluating the correctness and depth of students' explanations, their ability to apply relevant formulas and equations, and their proficiency in conducting calculations to determine heating and cooling loads.

Digital Competence:
Assessment Example: Students are tasked with utilizing digital tools effectively throughout the comparison project, such as spreadsheet programs, online research databases, and collaborative platforms.
Criteria for Evaluation: The assessment may involve evaluating students' proficiency in using digital tools to collect, analyze, and present data, as well as their ability to critically evaluate online resources for reliability and relevance. Additionally, their competency in collaborating with peers digitally and incorporating feedback into their work can be assessed.

Lifelong Learning Competence:
Assessment Example: Students are evaluated on their ability to reflect on their learning process, identify areas for improvement, and apply lessons learned from the comparison project to future endeavors.
Criteria for Evaluation: The assessment may include reviewing students' self-assessment reflections, where they discuss challenges encountered during the project, strategies employed to overcome obstacles, and insights gained from the experience. Additionally, their readiness to adapt to new technologies and methodologies in the field of heating and cooling systems can be assessed as indicators of lifelong learning competence.

- ***Evaluating Lesson Effectiveness****: (assess how effectively the lesson facilitated and improved the learning experience of students.)*

Student Engagement:
Observing the level of active participation and engagement demonstrated by students throughout the lesson.
Evaluating how instructional strategies capture students' interest and maintain their focus on learning objectives.

Learning Outcomes:
Measuring the extent to which students achieve intended learning outcomes, including understanding key concepts and applying new knowledge or skills.
Comparing students' performance before and after the lesson to gauge improvements in learning outcomes.

Feedback and Assessment:
Reviewing the quality and effectiveness of feedback provided to students during and after the lesson.
Ensuring alignment between assessment tasks and learning objectives to accurately measure student progress and proficiency.

Instructional Design:
Evaluating the coherence and effectiveness of instructional design, such as the sequencing of activities and clarity of instructions.
Assessing how instructional strategies cater to diverse learning needs and preferences.

Student Reflection and Feedback:
Soliciting feedback from students about their learning experience during the lesson.
Using student feedback to inform future instructional decisions and refine teaching practices.

- ***Optimization for Future Lessons****: (Gather students' feedback to refine and enhance future digital lessons.)*

Collecting Feedback:
Soliciting input from students about their experiences with the digital lessons, including what aspects were effective and what could be improved.
Providing various channels for feedback, such as surveys, focus groups, or one-on-one discussions, to accommodate different preferences and perspectives.

Analizan Feedback:
Reviewing and analyzing the feedback received from students to identify recurring themes, common suggestions, and areas for improvement.
Paying attention to both positive feedback and constructive criticism to gain a comprehensive understanding of students' experiences and perceptions.

Identifying Opportunities for Enhancement:
Using the feedback gathered to pinpoint specific areas of the digital lessons that could be refined or enhanced in future iterations.
Considering factors such as instructional design, content delivery, technology integration, and student engagement strategies when identifying improvement opportunities.

Implementing Changes:
Incorporating the insights gained from students' feedback into the planning and development of future digital lessons.
Making adjustments to instructional strategies, learning materials, assessment methods, or technological tools based on identified areas for enhancement.

Continuous Improvement Cycle:
Viewing optimization for future lessons as an iterative process, where feedback is continually collected, analyzed, and used to inform ongoing improvements.
Encouraging a culture of continuous improvement among educators, students, and other stakeholders involved in the digital learning environment.

- ***How confident the students feel in using mobile devices/apps in the classroom and in self-study?***

  The level of confidence students feel in using mobile devices and apps in the classroom and for self-study can vary depending on several factors:

  Previous Experience: Students who have prior experience using mobile devices and apps for educational purposes may feel more confident in utilizing them in both classroom activities and self-study. Conversely, those with limited exposure may feel less confident initially but could become more comfortable with practice.

  Digital Literacy Skills: Students' proficiency in navigating and using mobile devices and apps plays a significant role in their confidence level. Those who possess strong digital literacy skills, including the ability to search for information, interact with educational content, and troubleshoot technical issues, are likely to feel more confident in utilizing these tools.

Teacher Support and Guidance: The extent to which teachers provide support and guidance in integrating mobile devices and apps into classroom activities can impact students' confidence. Clear instructions, demonstrations, and opportunities for hands-on practice can help build students' confidence in using these tools effectively.

Relevance of Apps to Learning Goals: Students' confidence in using mobile devices and apps may also be influenced by the perceived relevance of these tools to their learning goals. When apps align closely with curriculum objectives and facilitate meaningful learning experiences, students are more likely to feel confident in utilizing them for both classroom activities and self-study.

Peer Influence: Peer interactions and collaborative learning experiences can also affect students' confidence in using mobile devices and apps. Positive peer modeling, peer support, and opportunities for peer teaching and learning can enhance students' confidence and encourage them to explore new apps and functionalities.