



Hackathons as an effective learning tool

Case: SAS Curiosity Cup

2024 Laurea



Laurea University of Applied Sciences

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Hackathons have become a popular tool in universities as they bridge the gap between working life and education. This thesis studies how participants perceive their learning development by attending the SAS Curiosity Cup, a global student hackathon sponsored by SAS Institute. The aim is to examine the student development of soft and hard skills learnt during the SAS Curiosity Cup. Research questions are the following.

RQ1: How can hackathons be used as an effective learning tool?

RQ2: How can the SAS Curiosity Cup help students to improve their data skills?

With the use of a literature review, own hackathon experience and a qualitative research, data was collected from participants, mentors and other stakeholders to get a better overview of the SAS Curiosity Cup. The study presents what results can be expected and gives first ideas how it could fit in Laurea's course curriculum. The empirical part of the study was conducted as a case study for the software company SAS Institute. Qualitative data was collected by semi-structured interviews with stakeholders of the SAS Curiosity Cup. The empirical data was collected between June and August 2023.

The empirical results and prior research highlight the importance of data skills and hackathons as an informal learning approach for students. The competences learned during the SAS Curiosity Cup were problem solving, collaboration, teamwork and innovative thinking. This implies that hackathons are an effective learning tool and should be implemented in the higher education system. This thesis presents first ideas how the hackathon can be implemented in an educational setting.

Keywords: SAS Institute, data skills, hackathons, universities, talent connection, collaboration

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List of Abbreviations

AI – Artificial Intelligence

ICD – International Data cooperation

ICT – Information and Communications Technology

IoT – Internet of Things

ECTS – European Credit Transfer and Accumulation System

UAS – University of applied sciences

LUAS – Laurea University of applied sciences

LbD – Learning by Developing

LMS – Learning management system

RQ – Research question

SAS Institute – Statistical Analysis System

UNESCO – United Nations Educational, Scientific and Cultural Organization

1 Introduction

Hackathons have been around since the 1990s but have become a hot topic in schools and organizations. The goal of a hackathon is to collaborate in small groups or in teams to develop a software, product or service in a limited amount of time, usually lasting from 1-3 days. The first hackathon took part in 1999 when OpenBSD brought together ten software developers to develop cryptographic software. (Hackathon 2023) The hackathons are also an effective tool in the education system. They allow students to collaborate and engage with other students and test or share their knowledge during the competition.

The SAS Curiosity Cup is a hackathon for students to compete against other students to test their data skills. Students join by submitting their own data set. This differs from other hackathons and the course assignment that take place in classrooms.

1.1 Context of the study

SAS Institute started in the late 1960s as a university project in North Carolina to develop a statistical software package which can analyze agricultural data. Since then, SAS Institute has become one of the largest privately held software companies of the world.

SAS Institute offers different solutions in data and analytics in over 147 countries including banking, insurance, healthcare, manufacturing, and retail. The software is used by over 83,000 businesses, government, and universities websites. SAS Institute offers a wide range of its software for students for free.

1.2 Research objectives and research questions

The aim of this study is to get more students interested in data science and analytics. The research objective of this thesis is to examine the SAS Curiosity Cup organized by SAS Institute. The aim is to identify the opportunities, challenges and limitations of the hackathon event to enhance participation. At the focus is to research how the hackathon can be embedded in Laurea's/UAS course schedule to offer students the SAS Curiosity Cup as an effective and collaborative project-based learning tool.

Different stakeholders of the hackathon are interviewed to get a better understanding how students benefit from the SAS Curiosity Cup and learning data analytics. The LbD action model used in LUAS is used as framework to identify how the SAS Curiosity Cup can be used as a project work for students and implemented as an informal learning approach for college students in Finland.

In addition, the LbD action model presents how data hackathons can be used to develop data skills of students and support the data skill gap in industries. The challenge is to get students learn SAS and increase the participation of the Curiosity Cup. This is done by interviewing different stakeholders of the Curiosity Cup to understand the motivational aspects of students.

Previous literature and studies related to data science hackathons have been reviewed. After the research, hackathons can be used as an effective learning tool and a powerful tool for the collaboration between industry and academia.

Two research questions have been formed for this thesis. The first research question focuses on how hackathons can be implemented in LUAS and other Finnish universities in Finland.

1. How can hackathons be effectively used as a learning tool?

The second research question concentrates on how students can learn and develop data skills by attending the SAS Curiosity Cup.

2. How can the SAS Curiosity Cup help students to improve their data skills?

1.3 Thesis structure

Chapter 1. This chapter includes the background, research problem and scope of the study.

Chapter 2. In this chapter, the theoretical framework to support the qualitative research and discussions. The chapter gives an overview how hackathons and data science courses in higher education are understood.

Chapter 3. The third chapter presents which research method was used for the studies. It describes how the researcher has made use of the qualitative research and triangulation method.

Chapter 4. The fourth chapter presents the finding and results of the studies. The qualitative interviews have been analyzed and related them to the literature review.

Chapter 5. The final chapter concludes the key findings and analyzes the previous findings of the chapter before. It also presents the limitations of the study and recommendations how the thesis can help for further research studies. The learning reflection of the author are discussed within the same chapter.

2 Hackathons

The term hackathon is a combination of “hack” and “marathon” where “hack” refers to programming and “marathon” to the limited timeframe. The majority hackathon events can be found in the IT industries but today it is possible to join music hackathons, HR hackathons or similar (Hackathon, 2021). The main idea behind hackathons is to solve challenges, develop skills or win price money. Students often participate for career opportunities and extend their network. Students have the possibility to directly apply their learnt knowledge and test their skills in industry.

2.1 Hackathons in the education system

Educational events like hackathons, naturally teach one of the newest 21st century “work survival skills” (Happonen et al. 2019, Lionaite M. 2020) and give students practical knowledge how to collaborate (Rantala 20212, Happonen 2019, Afshar et al. 2022) and the opportunity to investigate the practical usage of concepts by solving real-world problems (Afshar, 2022, SAS Institute 2023).

Encouraging students to enter hackathons to participate in competition like the SAS Curiosity Cup doesn't only have benefits for the finalists (SAS Institute 2023). By the use of open badges and LinkedIn articles students have the potential to be seen by future employers to showcase their knowledge and skills. With the participation on the SAS Curiosity Cup, students can show how they address real-word problems (SAS Institute, 2023) and that they are able to collaborate in a team. This is also one of the future working life skills which is one of the points in Laurea's pedagogical program for 2023 - 2025 (Laurea, 2023).

2.2 The importance of data skills

Data brings opportunities and tackles major issues, for example the Covid19 pandemic, but also carries risks which need to be understood and addressed (Benett et al. 2022). According to IDC, the world uses 175 zettabytes by 2025. (IDC, 2023). The digitalization, developing of new technologies, and the data driven economy behind the digital transformation are the main drivers of this growth.

The need of AI and data analytics are some of the major driving forces of the Fourth Industrial Revolution (Crawford and Smith, 2023). Artificial intelligence (AI) and Machine Learning (ML) become increasingly popular tools in various industries for example finance or healthcare (Stanford, 2021). There is an annual increase of 37% in demand of data scientists and related technical jobs. Data science jobs are one of the most wanted jobs according to LinkedIn Emerging jobs for the last three years running. (LinkedIn 2023)

With the amount of data that people are creating every day, there is no question that companies are looking for talents to digest this data.

Most of today's economies rely on data and this will increase within the next years as businesses constantly capture and collect data to provide personalized services (IDC 2023, Seagate 2021).

The knowledge of SAS programming skills can be an advantage for students as recently many Finnish companies use SAS Programming language. SAS Institute is widely used in larger Finnish companies for example Lähitapiola, Osuuspankki or Statistics Finland. Courses in data analytics can help students to find a workplace in Finnish companies.

2.3 Learning by doing action model

Higher education in Finland is based on a dual model where students can choose between Science Universities and Universities of Applied Sciences. While Science Universities focus on scientific research, UAS teach a practical and working based education. (Aalto, 2019)

Laurea UAS uses its own action model learning by developing (Lbd). The model involves students, customers, and companies to collaborate. The goal is to prepare students for the future working life and develop their skills with real life working experts to improve their employability. The basic elements of the LbD model are partnership, creativity, authenticity, research-oriented approach, and experiencing.



Figure 1 Laurea's action model Learning by developing (Laurea, 2019)

- Research oriented approach
- Partnership
- Authenticity
- Creativity
- Experimental nature

Most of the assignments are built together in groups or teams. In projects students complement each other and execute projects within a team. Students learn from each other. During team projects, knowledge can be applied or developed by students. Thus, student gain both soft and hard skills as they complement each other as they are required to discuss the project in groups. Project teams help students to build knowledge and develop or solve a problem within a team which develops soft skills such as collaboration, conflict management, creativity, negotiation or leadership. Also, hard skills are covered depending on the course and development project. In the P2P model, students work with a working life partner and get an assignment or project from a partner. (Aalto, E. et al. 2019). The following Figure (3) presents the P2P model from Dickinson.

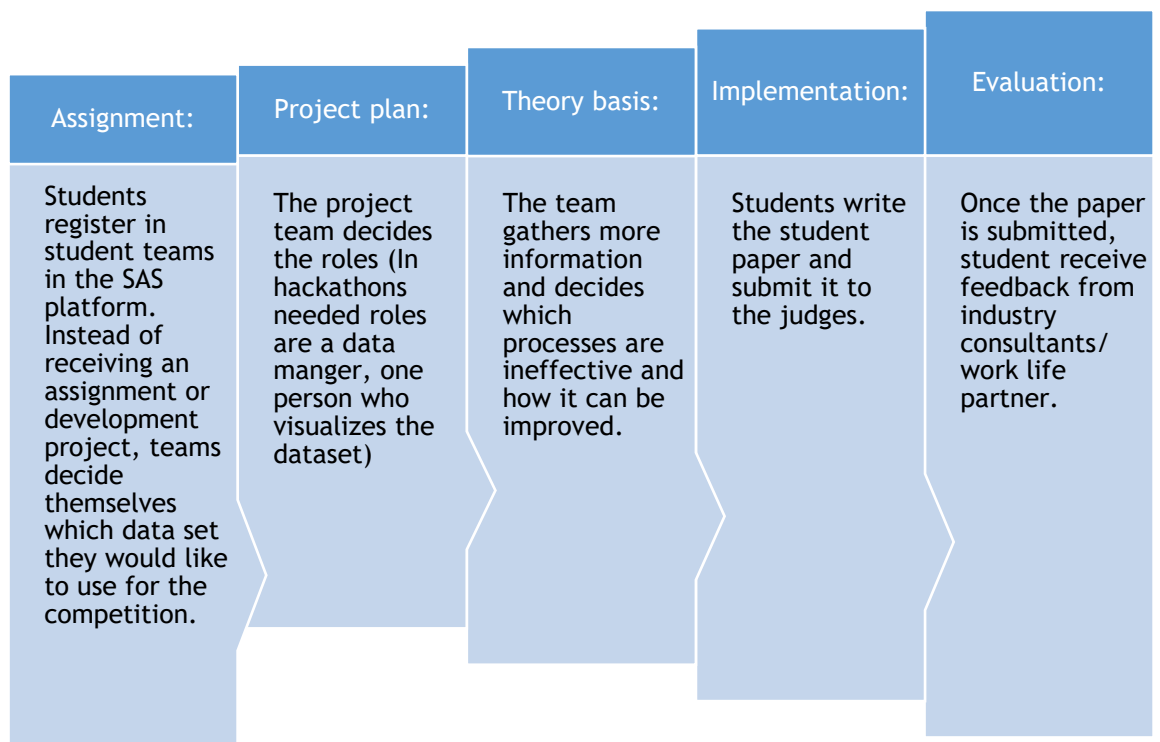


Figure 2 P2P, Educational process, adapted. (Dickinson, 2017)

2.4 The role of open digital badges

Open badges are widely used by information technologies (ICT) and act as a “visual token of achievement” and create a new opportunity to validate and recognize achievements digitally. Educational institutions and industries often use open badges to present their quality education with a particular focus on the lifelong learner. Additionally, open badges are easy to access and verify to promote social inclusion of disadvantaged groups, for example refugees, migrants or for individuals who don’t have access to face unequal access to education. (UNESCO, 2020).



Every student who participates at the SAS Curiosity Cup receives a Credly badge. Credly is an open digital badge on various social media apps and seen by potential employers. SAS Institute collaborates with Credly to give the opportunity for students to connect with employers and have it for future talent connection. While lectures at Laurea encourage students to connect with working life partners on LinkedIn after a project, SAS offers students a digital badge to showcase their skills. Credly gives students the opportunity to share their knowledge and participation on the Curiosity Cup.

Skills earned from SAS Curiosity Cup are: Analytical Problem Solving, Collaboration, Data Analysis, Data Preparation and Data Presentation” (Credly and SAS Institute, 2023). Through digital badges it is easy to attach additional information on the image file which employers can review for further access. According to Credly (2023), acquired skills after participation of the SAS Curiosity Cup are:

- Analytical Problem Solving
- Collaboration
- Data Analysis
- Data Preparation
- Data Presentation

Figure 3 (Credly, 2023) below shows the participant badge from which a participant can redeem from Credly by attending the SAS Curiosity Cup. Students who made it to the final round and winner of competition receive additional badges which can be shared on different social media channels. However, LinkedIn is recommended to be seen by potential employers.



Figure 3: SAS Curiosity Cup Credly Badge (Credly, 2023)

Also mentors and judges receive a Credly badge to support their collaboration with students and SAS Institute.

3 The SAS Curiosity Cup

The SAS Curiosity Cup is a global competition for students all over the world, where students can evaluate their analytic skills. Students join in teams with a public data set that is of interest to them and transform it by using SAS Viya, SAS OnDemand for Academics, or any University licensed software. In 2023, 52 teams from 16 different countries with a total of 150 students joined to challenge themselves to explore, analyze and learn from data that inspired their Curiosity. (SAS Institute, 2023)

The submissions are judged by industry consultants on three categories: data preparation, data analysis and data presentation. Students can develop their analytical skills and earn valuable certifications seen by potential employers. The judging by industry experts instead of SAS has several reasons. Instead of receiving feedback from their professor or peer feedback from students, SAS has decided that all submissions are evaluated by industry experts. Industry experts often have a different view how students analyzed or solve their data set. Moreover, industry experts have professional experience and can give constructive feedback to the submissions. (SAS Institute, 2023).

Students must be currently enrolled at a college, university or equivalent or have a status at the time of the conference. To participate a team must consist of a minimum of two up to four team members at the time of paper submission. (SAS Institute, 2023). Every student team requires a faculty or educator advisor. Students can only join one team while faculty advisors can supervise several teams at a time.

Student teams are able to demonstrate their skills in two rounds. The first round requires a two- to five-page paper that includes their data analysis using a SAS software and describe their results. The judging depends on their ability of data presentation, data analysis and presentation but also the overall paper structure.

After the first round is done, ten teams will be contacted for the finalist round. Eligible papers will be judged in the following categories: Data preparation 25%, Data analysis 25%, Data presentation 25%, and impact and conclusion 25%. The following table (Table 4) shows the assessment criteria adopted from the Terms and Conditions of Participation of the SAS Curiosity Cup 2023 (SAS Institute, 2023).

The assessment criteria has been slightly adopted to demonstrate how the grading could look like in Canvas, Moodle or other Learning management system used at UAS or universities in Finland.

Category	Assessment criteria paper submissions	Points 1 (vague, not given, poorly explained) to 10 (outstanding, one of the best)
Data preparation 25%	The data was adequately documented. The student explained adequately the data cleaning process.	1 - 10
Data analysis 25%	The student explained the use of analytical methods and the SAS software.	1 - 10
Data presentation 25%	The student provided attractive tables, graphics, and visualizations.	1 - 10
Impact and conclusion 25%	The student clearly defined the problem of their data set and provided the results to a non-technical audience. The submission includes compelling and coherent findings and gave recommendations for further research.	1 - 10
Total		4 - 40

Table 1 Assessment criteria of the SAS Curiosity Cup, adapted (SAS Institute, 2023).

Round two

The finalists round student teams are required to submit a video presentation on their given data analysis. Analytical stakeholders judge the video. The stakeholders judge on the overall organization of the presentation, the demonstrated subject knowledge but also the use of visuals and how students deliver the message of their dataset.

Winning Team

The winning teams of the SAS Curiosity Cup will be categorized in three groups. “data presentation, data analysis and presentation” receive recognition in many ways.

Winning teams receive a 12-month license to the SAS Academy for Data Science plus One SAS Institute certification voucher. The student is free to choose from any certification programs

by SAS Institute which can be for example SAS Viya or Programming. Winning teams receive one training voucher. The reason for winning a license instead of prize money is to encourage students to develop their skills after the competition and develop their job perspectives with certifications.

3.1.1 Timeline for the SAS Curiosity Cup

The table below (Table 2) shows the time frame for the SAS Curiosity Cup 2023/2024.

Month	Task
December - January	Registration opens. Student teams can register with their data set of their choice.
February	Paper submissions are accepted.
March	Video submissions for Round 2 are due
April	Winner and runner-up teams are selected.

Table 2: SAS Curiosity Cup Timeline (SAS Institute, 2023)

The timeline differs from regular hackathon, which are usually intense and happen overnight or usually within a few days. (Hackathon 2023). However, this SAS Curiosity Cup timeline could be more suitable for students studying at a university of applied sciences or universities. The approximate timeline is for teachers and mentors who consider implementing the SAS Curiosity Cup in their courses.

3.1.2 Variety of paper submissions

The variety of data sets played a significant role in the hackathon. Students are required to submit their own data set and develop a business case by using SAS software. Students can choose their own topic of interest but it also requires an understanding for business processes why a business is ineffective and how it can be improved by using data analytics.

The submissions of the data sets for the SAS Curiosity Cup 2022/2023 have been categorized to the following categories:

1. Leisure and Entertainment
2. Medicine and Life science
3. Nature and Environment
4. Transportation
5. Banking and economy

Students were able to transform data sets of different topics with SAS Viya or SAS on Demand for Academics and evaluate them with results. Topics covered different topics, from comparing different classification models predicting diabetes or investigating if a game in the game LoL (League of Legends) is lost or won after the first 10 minutes to analyzing hotel reviews from TripAdvisor.

The following graphic (Table 3) shows the different submissions of the SAS Curiosity Cup 2022/23.

Dataset	
Leisure and Entertainment	(Spotify Data 1921-2020) Red Wine Quality Speed Dating Experiment League of Legends Ranked Games
Health and life science	Diabetes, Hypertension and Stroke Prediction National Survey on Drug use and Health Diabetes Health Indicator Set Suicide rate overview 1985 - 2016 Heart disease Data set Walkability index and Alzheimer disease and Healthy aging data 2020 BRFSS Survey

	<p>230117COVID19MEXICO.csv</p> <p>datos_abiertos_dengue 29 de diciembre 2022</p> <p>Latest reported counts of cases and deaths & "Vaccination data</p>
Nature and Environment	<p>Welch et al. (2022) Hotspots of unseen fishing vessels</p> <p>Sustainable Development Report; Olympics dataset; Human development report</p>
Banking and Economy	<p>Eurostat</p> <p>HICP</p> <p>Stock Market Dataset (NIFTY-500)</p> <p>Police Killings</p> <p>Overcrowding rate by age, sex and poverty status - total population - EU-SILC survey</p> <p>Social influence on shopping</p> <p>Higher education wedges</p> <p>Iowa liquor sales data</p> <p>Bp-stats-review-2022-all-data</p> <p>Relationship Between the Online Behaviors of Consumers and the E-Commerce Sales of Enterprise in Europe</p> <p>WiDS Datathon 2022</p> <p>Miedo a AMLO</p> <p>Predict students' dropout and academic success.</p>

	Home Credit Default Risk
Transportation	Non-Intrusive Load Monitoring Yellow Taxi Trip records Flight status Prediction Car crash dataset Florida department of transportation state safety office GIS UCS_Satellite Database

Table 3: Variety of Paper Submissions of the SAS Curiosity Cup (SAS Institute, 2023)

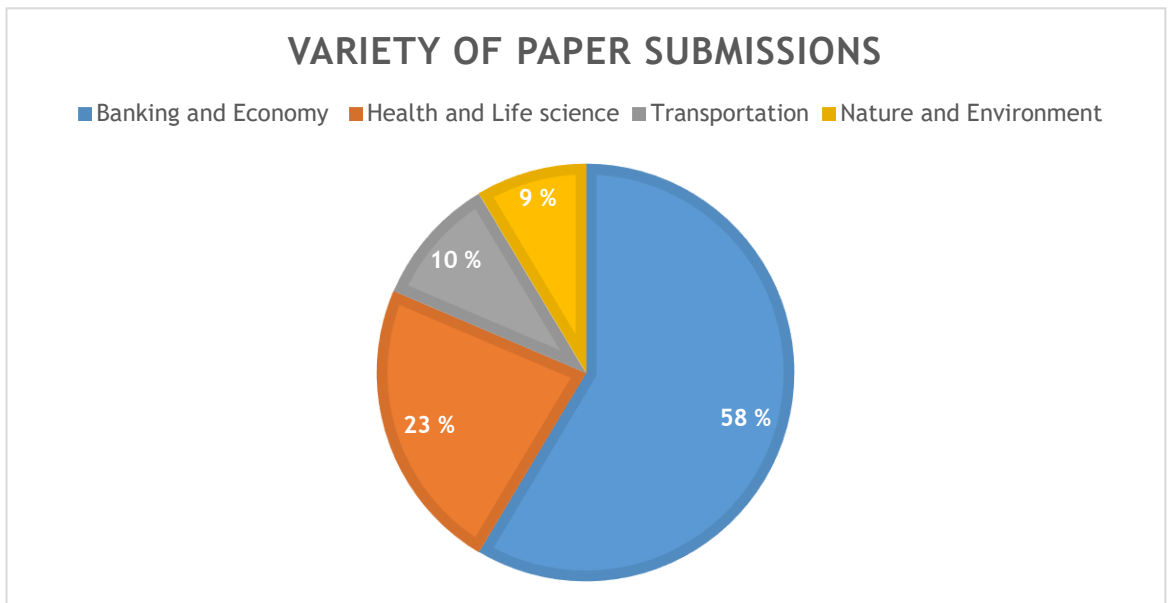


Table 4 Variety of paper submissions of the SAS Curiosity Cup (SAS Institute, 2023)

Students chose a data set that caught their curiosity. The winning team from Romania mentioned their passion for data science and raising awareness deforestation. The team created a model to detect deforestation by classifying satellite images. Another team, who was one of the winners, compared different models of predicating diabetes.

Students can choose a data set of their own, personal interest and analyze it for the competition.

4 Research method

The following chapter contains the methods used for the study. Firstly, the qualitative research and data triangulation will be discussed. This chapter will also illustrate a description of the case study.

4.1 Qualitative research approach

The qualitative research is a research method that is often used in social sciences, psychology, or education. Qualitative research aims to answer the research question by collecting data from interviews, people's observations, or case studies. (Creswell, 2023, XX). The research is interpretive as researchers try to make sense of participants meanings and try to conclude relationships between the phenomena.

For this research, the qualitative research method was used to collect data with in-depth, semi-structured interview to get a better understanding of previous participants and stakeholders of the SAS Curiosity Cup. The stakeholders were divided in five focus groups. The interview framework had thematic questions for participants, mentors, judges or SAS representatives. Interviewees were invited with e-mail asking for voluntary participation. A meeting was then agreed on teams and the questionnaire was send beforehand.

The interview was carried out on teams and recorded for later analysis. The study examines the learning development during the hackathon and how students can improve their data skills by attending the SAS Curiosity Cup. The interviews were conducted to define the programming and data skills of students to determine the prerequisites for the SAS Curiosity Cup. Also questions on learning development and soft and hard skills were identified and then compared with the Lbd action model used in LUAS.

4.1.1 Data triangulation method

Data triangulation is a popular data collection method in social sciences. Data triangulation method defines when more than one data collection method was used. The purpose of data triangulation is to increase the validity and reliability of the research and can support the research question or research objective.

The type of data triangulation in this research include the qualitative interview, data collected from public data bases, internal meeting notes from e-mails, meetings, documents

and observation. The following table (Table 2) shows how the data was collected during the research progress.

The secondary data sources were collected from Google scholar, ProQuest and Laurea library and analyzed. The literature research helped to understand the phenomenon of the research and supported the analysis in the qualitative research.

Technique / Purpose	Literature type	Type of data
Interviews	Qualitative, primary research	9 participants, semi- structured
Case study	Qualitative, primary research	Researcher notes, chat log, meeting notes, e-mail. observation
Collection of internal documents	Qualitative, primary and secondary research	Variety of paper submissions, Credly analytics, articles and community posts
Collection of different databases	Qualitative, secondary research	Google scholar, ProQuest, Laurea library

Table 5 Data collection techniques

4.1.2 Research design

This thesis is based on an exploratory sequential mixed research design. According to Creswell (2023, 17) the exploratory sequential research design the researcher starts with qualitative research and observes the view of the participants. The interview data is then analyzed and information is used to conduct a survey, the quantitative research. The reason for choosing this design is to get different views and insights from participants who had a direct or indirect relation to the SAS Curiosity Cup.

5 Data collection

5.1 Ethical consideration

For ethical reasons, the collected data does not include any sensitive information such as names, phone numbers or e-mails. The gathered data follows the GDPR guidelines. Research requires collecting data about people or individuals which can lead to ethical issues. (Punch, 2014 & Creswell et al.2023). All participants were given the clear background to the purpose of the study and participated voluntarily in the research. The interview questions were sent in advance so that the interviewee had some time given to prepare the questions beforehand. The participants are anonymized to protect their privacy.

5.2 Population and Sampling

According to Creswell (2023), a study population refers to all people a researcher draws conclusions about, for example every person participated in a hackathon or has data science skills whereas a study sample refers to a subgroup of participants examined in the survey study. Therefore, the target population of the qualitative interview was determined on stakeholders on the SAS Curiosity Cup.

The target population for the survey was aimed to previous participants and other stakeholders of the SAS Curiosity Cup.

Since it was not possible to interview all SAS Curiosity Cup participants, a systematic sampling was selected. The Excel document from previous SAS Curiosity Cup participants was used and students were randomly selected and contacted for an interview. (Fowler, 2014, Creswell 2023, 162)

To get different objectives on student's learning objective interviews were conducted with people who had either a direct or indirect relation to the SAS Curiosity Cup. The main focus of the interviews lies on the employees who are teaching SAS Viya in schools or work in talent connection. The Qualtrics Survey was sent to participants of the year 2022 and 2021.

5.2.1 Data collection method

Semi structured interviews were conducted to get a better understanding and a different view on the competition. A total number of eight interviews was collected on Teams with the focus on data skills trying to identify the personal development of students before and after the SAS Curiosity Cup. (Table 3)

The interviews were conducted between June and July 2023. One of them was on-site, the remaining interviews were on Zoom and Teams. Among the interviews was one conducted in

German, while the rest of the interviews were conducted in English. All interviews were recorded and transcribed. The participants were chosen based on their experience and relation to the SAS Curiosity Cup. Four of the interviewees were managers, one of them was a professor, two were previous participants and a judge of the SAS Curiosity Cup. Choosing interviewees only by one organization might affect the results. To avoid this problem, participants with different roles have been considered for the interview.

Participant	Location	Date	Role	Duration
1)	Finland, EMEA	19 June 2023	Global Academic Program Manager	45 min
2)	Slovakia, EMEA	17 July 2023	Global Academic Program Manager	20 min
3)	Germany, EMEA	27 July 2023	Sr. Global Academic Program Manager	25 min
4)	Finland, EMEA	21 July 2023	Former Judge	
5)	Romania, EMEA	1 August 2023	Academic Program Manager	30 min
6)	USA, NA	15 August 2023	Mentor/ Faculty advisor	30 min
7)	Denmark, EMEA	15 August 2023	Participant	30 min
8)	Denmark, EMEA	15 August 2023	Participant	30 min
9)	Canada, NA		Judge	30 min

Table 6 List of the participants for the interviews (SAS Institute, 2023)

5.2.2 Data availability statement

The interviews were collected and recorded through Teams with video and live transcription. The recordings were saved to the local computer and automatically deleted after 60 days to follow organizations policies.

5.3 Reliability

Reliability refers to consistency and replication. When conducting research, it is important that every interviewee receives the same interview framework. The interview framework is attached in the appendices. Individual Interviews were conducted on teams and Zoom. Only students, who participated in the same student competition were considered to interview as focus group. To enhance the reliability of the study, the survey was pilot tested and sent to 14 participants.

To avoid bias and increase reliability, the researcher needs to ensure that the questions are phrased clearly that the interviewee can understand them. Only interviewees, who had had a relation to the hackathon were selected.

5.3.1 Validity

Creswell defines that validity is one of the strengths in research and is based on whether the findings are accurate from the author, the reader, or the participants standpoint (2000, 213). The qualitative literature also discusses the trustworthiness, credibility or authenticity of the research (Creswell & Miller, 2000, 213). According to Creswell J. and Creswell W. (2023) recommend that researchers should incorporate validity strategies to their proposal to enhance the accuracy of the findings.

Good qualitative research also means to avoid bias shaped on the participants or interviewees background such as gender, culture, history or socioeconomic origin (Creswell, 2013).

As the aim was to understand the learning development of college students by attending a hackathon, interviews from different countries were conducted to get a wider sample of the data collection. The interview data was then analyzed to identify the major findings of the interview.

5.3.2 Delimitations

As every study, the thesis has some limitations. The idea to build a relationship with universities and professors is effective as it often leads to long-term relationships.

Furthermore, the author limits the study by connecting directly with universities, professors and students. Building the brand awareness through social media has been given as consideration but due to competitors with a larger community and more popular analytic software might be recognized by students by the brand name or other elements.

The study explores how data skill can be developed by attending the SAS Curiosity Cup. With the research problem defined in section 1.1, there are multiple ways to learn data science and companies use different programming languages based on their business needs. However, the research focuses on a single case study and researches the SAS Curiosity Cup sponsored by SAS Institute. Additionally, the SAS Curiosity Cup by SAS Institute uses its own software SAS Viya. Therefore, the focus on the study is SAS language.

6 Findings and Results

6.1 Interviews

For the interview 7 different stakeholders were contacted to get a different objective of the SAS Curiosity Cup. The chosen interview participants had different stakeholder positions such as previous participants, mentors, and SAS Institute representatives. The focus for the interviews were previous participants of the SAS Curiosity Cup and employees who are teaching SAS Viya in universities. The interview data was then analyzed and categorized into different categories.

6.1.1 Hackathons as an effective learning tool

The use of hackathon as an effective learning tool was one of the main discussion points. Interviewees were asked about their role and observation of the SAS Curiosity Cup.

One of the interviewees joined a hackathon sponsored by the University of Mainz in a role of a data management expert. The focus of the healthcare hackathon in 2023 was to use digital transformation to assist personnel. He teaches SAS Viya in different universities of Germany. Furthermore, he helps students to get certified and was a previous attendee of the “Healthcare marathon Mainz” in Germany. (3, 2023). From his objective and hackathon experience, the SAS Curiosity Cup and hackathon can help students to develop their data skills. However, the SAS Curiosity Cup might be a challenge for students who just started learning SAS Viya or don’t have experience with the software.

One interviewee had the opinion that hackathons are an excellent opportunity to develop skills and that the competition is suitable for students, who just started with SAS language. It can be a challenge for students as in hackathons results need to be presented in a short amount of time. He mentioned that hackathons are normally difficult to implement in educational settings since during traditional hackathons, attendees are required to develop and present ideas often overnight or within a few hours.

“The main idea of a hackathon is to understand the problem and generate first ideas on the solution of the problem.” (3)

“It is everywhere. Something that’s already happening. It is important understand the value of the data.” (1)

Academic Managers and faculty professors had the opinion that the SAS Curiosity Cup has a potential to be implemented in the Laurea’s curriculum.

A mentor from the USA, who has been giving lectures just tried the SAS Curiosity Cup with her students with a great result. She also recommended to create student teams with different skills to complement each other.

We do a lot of our assignments in groups, so it's very normal for us to be working on a team. It helped us reaching our goal, as we can make use of our strengths and weaknesses. (7)

It was fun to get to work with my team member on a project we chose ourselves. I think we couldn't have handed in if not for the teamwork! (8)

6.1.2 Competences developed during the SAS Curiosity Cup

Interviewees were asked what competences they think can be developed during the SAS Curiosity Cup. Majority of the interviewees mentioned teamwork, collaboration, the use of technical skills, problem-solving and skepticism and curiosity. One of the interviewees mentioned the understanding of business processes.

- Technical skills
- Understand Business Processes
- Teamwork and Communication
- Problem solving
- Curiosity
- Skepticism / Data literacy

The interviewees were asked two main questions. The importance of data skill and why they think data science courses are important and should be integrated in the higher education system.

I had done the free for students SAS online programming course, but nothing more. Everything felt completely new at the competition! (7)

I had never tried SAS before we signed up for the SAS Curiosity Cup but have a lot of experience with other programming languages, and generally I'm very good at problem solving. Everything I needed to use SAS I learned after signing up. (8)

6.1.3 Hackathons as an informal teaching approach

One discussion point was how interviewees think about including the SAS Curiosity Cup in the education system. One interviewee answered that her students participated voluntary but mentioned that one degree program on her university already have hackathons in their

curriculum. The previous participants said that they liked to use their topic and data set of their choice compared to their predefined assignments from their teacher. Both students mentioned the use of their own data set was interactive and different to course assignments. The SAS Curiosity Cup was good opportunity to directly apply the learned data science skills from the course and get hands-on experience by solving real-world problems that goes beyond traditional classroom learning.

“You have to be an expert in data analytics.” (6)

6.1.4 Motivational aspects of the SAS Curiosity Cup

Interviewees were asked why they decided to attend the hackathon. One of the students never attended a hackathon or even had experience with SAS language. He learned SAS language during the competition and attended with her fellow student. They both mentioned that the reason they attended was that they could choose an own data set or assignment as they were used to get their topics by their teachers. They joined with the dataset LoL (League of Legends) which is an online game and predicted whether a game was lost or won after the first ten minutes (SAS Institute, 2023). This is however unique and only possible on the SAS Curiosity Cup that students can participate with a data set of their own choice (SAS Institute, 2023).

“SAS Curiosity Cup is a data analysis competition where you get to choose your own problem, dataset and course of action.” (8)

“Data analysis and fun - Explore what interests you!” (7)

“It’s a very open competition which is really nice, as you can look at data of your own interest. We chose to do something about League of Legends because we play it with our friends and it would be a lot of fun to tell them about which factors do/don’t affect the game.” (7)

6.1.5 Hackathons to enhance employability.

The interviewees were asked about their motivation to attend hackathons. In their response one of the main points was the opportunity of networking and to showcase their skills in their resume. Interviewee (8) mentioned that students were looking for a better job once they graduate from their master’s program. One of the students worked with SAS language at his work already and found the hackathon a great opportunity to add to his portfolio. One of the interviewees mentioned that she found a job after the participation in the SAS Curiosity Cup.

The use of open badges was also discussed in the interviews. With the use of Credly badges, which is an open badge and can be shared on social networks for example LinkedIn, makes it possible to be seen by other employees or industries.

“SAS Skill builder is a clear advantage and students will much more employable and attractive for future employees.” (5)

“I am currently looking for a job. When I talk to people about SAS Curiosity Cup, they are impressed about how far we got. I Think however it is hard to say if that's the reason I got job interviews.” (8)

6.2 Answers to the research questions

RQ 1: How can hackathons be effectively used as a learning tool?

The main reason of the interviews was to identify what students learn to Laurea's curriculum. Most of the interviewees mentioned that attending the hackathon helped them to develop their data skills and two of them mentioned that they found a job placement after the competition.

The Credly badge, which can be earned after successful participation, states following skills: Partnership, 2) Authenticity 3) Research oriented approach, 3) Creativity and 4) Experiential Culture (Figure 3).

This shows that the SAS Curiosity Cup supports the research-oriented approach and fits in the pedagogical model LbD in Laurea. Laurea's students and teachers could benefit from the hackathon.

With the usual tight schedule integrating hackathons might be difficult. However, with the longer timeframe of the SAS Curiosity Cup the hackathon is suitable to integrate in a curriculum in LUAS or university curricula (Table 2). Laurea's competence-based curricula consists of different modules which can be grouped in study units and projects. Modules can be part of the complementary or elective studies. (Limitations)

Students usually take several courses and projects to demonstrate their competence in the subject area (Laurea, 2021, 5). According to Laurea's general guidelines, the SAS Curiosity Cup can be assessed as other studies and follows the European credit system, where one credit is equivalent to 27 hours of studies. As the course will be evaluated by industry consultants, the course can be graded as Pass/Fail scale. (Laurea, 2021, 14). The degrees at Laurea consist of basic and professional studies with core (mandatory) and complementary (elective) studies.

The SAS Curiosity Cup can be integrated in Laurea's study program following the Service Design implementation in LUAS. The course consists of two separate sections, the First Theory Part (2 ECTS) where students study independently in the Skill Builder environment to acquire necessary Visual analytical skills needed for the competition. The Theory Part (5 ECTS) is the paper submission of Round 1 of the hackathon competition. Students receive the study points after successful submission. (Table 7)

The submissions are graded by SAS Institute and sponsored by industry consultants. The competition helps students to develop and submit clear papers to prepare for thesis and larger paper submissions. (See table 1) There are no requirements or recommendations on the student's academic level besides enrolled in a university or have a student status however,

SAS Institute states that “submissions should be appropriately technical, but still understandable to non-analytics audiences” (SAS Institute, 2022).

To motivate Laurea students and complete the competition, it is recommended to enroll to the Business Analytics course or study independently in the SAS Skill builder environment and complete the courses Visual Analytics 1 and Visual Analytics 2.

Additionally, volunteer work such as tutoring are awarded.

	Course Name	ECTS
Theory Part	SAS Visual Analytics Basics and Advanced <i>SAS Visual Statistics</i>	3 ECTS
or	Business Intelligence (R0404)	no additional study points
Practical Part	SAS Curiosity Cup	3 ECTS

Table 7 First proposal how the Prerequisites of the SAS Curiosity Cup could be offered in Laurea’s curriculum.

Study points also increase the participation of competition. During an interview with an SAS institute employee mentions that it is general more awarding for students. The number of submissions significantly increased in the universities which implemented in their curriculum.

RQ 2: How can the SAS Curiosity Cup help students to improve their data skills?

Students can currently learn the programming language on the SAS Skill Builder environment free of charge. (SAS Institute, 2023). The hackathon is a great opportunity for students who know SAS and would like to test or develop their data skills in a competition and receive feedback from industry consultants. (Table 1).

The competition is for everyone and for SAS beginners, ideally the competition is for students who have SAS knowledge from work or would learn SAS in the classroom and get practice. When students feel ready, they can sign up in student teams and do the competition (4, 7).

Instead of price money, students get twelve months of access to the SAS Academy for Data Science, a SAS digital badge acknowledging winner status and a certification and course voucher. This pursues the target to encourage students to develop their data skills even after the competition or giving them money as a price.

- Innovative thinking
- Use their own data set of their interest (Denmark team)
- Learn where is a process and try to analyze it
- Data literacy
- Helps to understand data better.

6.3 Limitations

Although the study provided a great result, there are always limitations in research. The following chapter will discuss the limitations of the study. Firstly, the study has only researched one hackathon, the SAS Curiosity Cup sponsored by SAS Institute. That's important and keep in mind that the results and conclusions may not fully apply to other hackathons due to a difference in timeline, objective, and concepts. In this case, a study of different student hackathons could have provided a broader perspective and opportunity to compare different outcomes.

The purpose of this study was to research how data skills can be developed or learned by attending the SAS Curiosity Cup. Most participants were students enrolled in a Computer Science, Machine learning or Programming degree and had taken programming courses before or experience with SAS programming. The students interviewed were enrolled in a master's program and had SAS experience. (SAS Institute, 2023). Therefore, the SAS Curiosity Cup might be more suitable for second year students and experience in SAS programming skills. However, a student team from the USA used a different SAS software and learned SAS Viya from the start. The student team performed very well and was able to submit the paper (7). Another student joined a team with SAS programming experience and submitted their final paper.

Furthermore, other programming languages might be better known by students. According to Forbes, the most popular analytic software is Microsoft Power BI, followed by Tableau and Qlik sense (Forbes, 2023). Therefore, a study module where students first learn the programming language SAS and then join the SAS Curiosity Cup has been found for the most effective method to build relationships with faculties and professors. The SAS Skill builder has been integrated in different courses already and could be developed to deepen the knowledge of students and get more hands-on experience with a competition.

7 Implications

This paper presents practical and theoretical implication how the SAS Curiosity Cup can be developed by implementing the hackathon in LUAS and other universities in Finland. The practical implications can be found in chapter 6.1. Theoretical implications and suggestions for further research are presented in chapter 6.2.

7.1 Implications for practice

The following suggestions are for professors/lectures in Laurea and other universities in Finland who plan to implement the SAS Curiosity Cup in their curriculum.

- The Curiosity Cup is great for students to explore SAS and data analytics. However, SAS knowledge and understanding of Business processes are essential to submit a successful data set. Professors and lectures can give more information to the students and teams may be created in Canva, Moodle or other LMS to cover all strengths for each team.
- Study units, elements or projects are graded using a scale from 1 to 5. When a student does not meet the objectives of the study unit, the course will be graded as HYL/Fail. A study unit or project can be also evaluated as HYV/Pass. The grading criteria are always in the implementation plans. (Laurea, 2021, 14)
It can be considered to give students a Pass/Fail or graded from 1-5 as the assessment criteria are clearly defined and students receive feedback to their paper submissions.
- Laurea offers the Business intelligence course where students can learn data analytics and SAS. If the Business intelligence course seems too popular or a student misses the enrollment period, students can learn independently with the SAS learning platform for students. Students can register to the SAS Skill builder and study the materials in the learning environment. Recommended are the courses SAS Visual Analytics for beginners and SAS Visual Analytics for advanced. Lectures may select the student groups and form teams between Business Management and Business Information students.

Secondly the use of QR codes will help the SAS Curiosity Cup to attend and register at the event. Working with more QR codes can be also taken for SAS into consideration.

- For the SAS Curiosity Cup, a QR code could be created which contains a short video invitation for students to present what the SAS Curiosity Cup is about and why they should attend. Students share the codes with their mobile phones to other students, get more information and pre-register to the hackathon.

- To promote the Curiosity Cup posters will be displayed in universities and used for SAS talent connection event to increase the participation of the SAS Curiosity Cup. By engaging with students and teachers in a physical place like a university, students can interact with the QR code and communicate with other students about the event. This has several advantages. The main reason is that students are together with their fellow students to ask them to join. If they have additional questions, teachers are available to give them more information about the event.
- Using QR codes for the SAS Curiosity Cup can also help SAS to collect student feedback. While the author has noticed that it's difficult to collect responses and student e-mails may not be delivered or seen anymore, QR codes can be scanned quickly to increase the response rate.

7.2 Theoretical implications and further research

This study focuses on why data skills are an essential skill for students and how it can be improved by attending the SAS Curiosity Cup.

For future research, more data could be collected from Laurea students or other Finnish students to demonstrate why data science courses are valuable for every degree and important for everyone. It is suggested that Laurea professionals read the terms of conditions and the outcome of the SAS Curiosity Cup to determine the number of study points. This will award students and may increase the participation of the SAS Curiosity Cup.

The SAS Curiosity Cup could be offered as a pilot course and then compared with a similar project or study module to identify what skills students have learned by attending the hackathon. This can be done by a study unit feedback at the end of the competition.

QR codes are a simple way for ticket scanning, such as getting access to concert venues, museums or sport arenas but can also be used in an effective way to share information about a website or an album release, for example.

According to Statista, it is expected that 100 million users will have a QR code scanner on their phone by 2025. In 2022, 89 million users scanned a QR code on their mobile device. The usage of QR code scans have been increased by 25% compared to 2020 and it's on a constant raise. (Statista, 2023). This makes it an effective marketing tool to engage with students. QR codes could display in student lobbies to increase the participation of student teams.

Other industries could use the SAS Curiosity Cup also to find data talent. SAS Institute would offer the platform for external companies who recruit data talent and choose their best candidate based on their submission. The SAS Curiosity Cup as an assessment tool could help

to industries to close the skill gap in data science related jobs. (SAS Institute, 2023, Forbes, 2023). Companies, for example Newsec, already uses cases for applicants to test their knowledge (Newsec representative, 2022). Many companies use a dataset competition or dataset as assessment for future candidates already. Fix-a-Thon, a Hackathon sponsored by Microsoft hires final engineering students who win the contest. (Microsoft, 2023).

A survey has been created to develop future SAS Curiosity Cup. Due to the limited responses, the survey has been left out of the thesis as it may limit the generalizability of the findings. The reason might be that some time passed since the last SAS Curiosity Cup. However, the survey has been attached in the appendix to develop the upcoming SAS Curiosity Cup.

To increase the response rate, SAS certification vouchers can draw among all participants.

8 Conclusion

The purpose of this thesis was to research the learning development of students by attending the Curiosity Cup to develop a proposal for students in universities integrating the hackathon in their curriculum. Building the bridge between academia and industries is crucial for SAS Institute because students are the future job keepers using SAS.

By implementing the SAS Curiosity Cup in Laurea UAS, it can help students for future job prospectives knowing SAS and data skills and strengthening the relationship between SAS Institute and Finnish universities.

The thesis examined the learning development of students by attending the hackathon. Stakeholders from the SAS Curiosity Cup were interviewed to get a better understanding what the learning development of students are and to identify the learning prospectives to promote the hackathon in Finnish universities. Since there were no previous literature how to successful implement a hackathon in universities, the aim of this thesis was to identify the learning objectives to give teachers a guideline how the SAS Curiosity Cup can help students to learn data analytics and collaboration between industries and academia.

In conclusion, there are several reasons why students attend hackathons. From the authors experience, universities should offer more data hackathons to get students interested in learning data analytics to develop job prospectives.

Comparing the main results of the study with the theoretical framework, the research objective of the development project was reached. Students attending the SAS Curiosity Cup is based on following key concepts: 1) collaborative learning, 2) problem-solving, 3) knowledge-based learning 4) curiosity.

8.1 Learning reflection

The research for the thesis helped me to gain more expertise in the Academic and Education department at SAS Institute. The Education department in SAS institute offers various products and services for the customer depending on their needs and data science is a wide topic through data analytics and hackathons are a relative broad area and many topics are addressed in work meetings. The author developed a project to strengthen the relationship between SAS Institute and universities.

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Appendix 1: Interview Framework

Interview Questions for mentors and slightly adapted for SAS Institute employees.

- The interview will take approximately 30 minutes.
 - Is it okay for you if I record the call?
 - Your name will remain anonymous but I will differentiate whether the interviewer is a participant, mentor, or judge.
 - Your answers will only be used for the purpose of the thesis and
 - If you don't wish to answer a question, please let me know and we jump to the next question.
 - Are there any questions before we start the interview?
-
1. Tell me a little bit more about yourself. How long have you been teaching on your university and what current subjects do you teach at your university/college?
 2. Where are you based?
 3. UMGC's paper was accepted as one of the ten finalists and later won the competition in the data presentation category, out of three categories. How did you help your team to prepare and motivated for the contest?
 4. Would you recommend the SAS Curiosity Cup for students who just started with SAS Programming?
 5. What competencies/prerequisites do you consider to be crucial for reaching the objectives in the SAS Curiosity Cup?
 6. Do you think the SAS Curiosity Cup/ hackathons should be integrated in the education system? If not, why?
 7. How was the feedback from your students and do your courses include group work?
 8. How did the project differ from your course plan?
 9. Do you think data science courses are crucial for students in future?
 10. You are teaching the SAS Skill Builder on your university/UAS. What feedback do you receive from your students?
 11. Is there something you would like to add or mention what could be relevant for the interview?

interview framework for participants

1. Where are you currently reside?
2. What is your occupation?
3. Which degree program are you pursuing?
4. How did you come across the Hackathon, have you joined Hackathons before?
5. Why did you decide to participate the SAS Curiosity Cup?
6. How many hours did you spend on the project?
7. Did you have sufficient SAS Programming skills or did you develop your skills during the competition? If not, you are welcome to mention other programming languages which have helped you for the competition.
8. How did you like working with fellow students? Have you worked with other student teams before and do you think it has helped your submission?
9. Have you learned something new that hasn't been taught in your courses yet?
10. Has the SAS Curiosity Cup changed or supported your career plans or helped you to find a work placement/internship?
11. If you would tell your friend about the SAS Curiosity Cup, how would you describe the competition/hackathon in one sentence? You can describe your learning experience, opportunities, or factors of the competition.
12. Is there something you would like to add or mention what could be relevant for the interview?






Appendix 2: Overview of the interview samples

Participant	Location	Date	Role	Duration
[1]	Finland, EMEA	19 June 2023	Global Academic Program Manager	45 min
[2]	Slovakia, EMEA	17 July 2023	Global Academic Program Manager	20 min
[3]	Germany, EMEA	27 July 2023	Sr. Global Academic Program Manager	25 min
[4]	Romania, EMEA	17 July 2023	Academic Program Manager	30 min
[5]	USA, NA	15 August 2023	Mentor/ Faculty advisor	30 min
[6]	Denmark, EMEA	15 August 2023	SAS Curiosity Cup Participant	30 min
[7]	Denmark, EMEA	15 August 2023	SAS Curiosity Cup Participant	30 min
[8]	Canada, NA	30 October	Industry judge	30 min

Appendix 3: SAS Curiosity Cup poster

SAS® Curiosity Cup 2024

Global data science competition for students that challenges the next generation of analytics experts to explore, analyze and learn from data on topics that inspire their curiosity

	Dec 1st - Jan 31st	Register your Team (2 - 4 students + Educator)
		Use SAS® Software to analyse your Data, either in SAS 9 or SAS Viya For Learners
	Dec 15th - Feb 21st	Round 1: Paper Submission Closes
	until March 27th	Round 2 (for the 15 best Teams): Video Submissions Closes
	mid April	Winners Announcement in Categories: Data Preparation, Data Analysis, Data Presentation

Exciting Prizes for the Winning Teams

Each participant of SAS Curiosity Cup will receive a SAS Digital Badge and 12 months of access to the SAS content subscription of their choice.

Each student member of the top team in each category may select one of the prizes: Apple iPad Air - 5th Gen, Beats Studio Pro Headphones, Panasonic Digital Camera, Ruko F11PRO Drone, and many more...



Unlock your Curiosity

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