DISTINCTIVE FEATURE 'SMALL-SCALE AND INTENSIVE EDUCATION'

BACHELOR APPLIED DATA SCIENCE
& ARTIFICIAL INTELLIGENCE
Breda University of Applied Sciences

FULL REPORT
3 JULY 2023

Content

1   Procedure NVAO

Dutch higher education programmes (or tracks contained within such programmes) may get permission from the Minister of Education, Culture and Science to select students at the start of the programme and demand a higher legal tuition fee, if they meet the criteria for the distinctive feature 'Small-scale and intensive education'.

This concerns programmes with small-scale and intensive education that aim for an above average education efficiency and where the activities inside and outside the curriculum are connected. The criteria for the special feature are included in the framework: 'criteria pertaining to distinctive feature of "Small-scale and intensive education"' (NVAO, January 2018).

The distinctive feature is assessed by means of peer review. A panel of independent peers including a student reviews the plans during a site visit to the institution. A discussion amongst peer experts is the basis for the panel's final judgement and the advisory report. The agenda for the panel visit and the documents reviewed are available from the NVAO office, upon request.

The outcome of this peer review is based on the criteria described and published in the above-mentioned 'criteria pertaining to distinctive feature of "Small-scale and intensive education"'. Each criterion is judged: meets the standard or does not meet the standard. Subsequently, the panel reaches a final conclusion about the quality of the programme: positive or negative.

This report contains the findings, analysis and judgements of the panel resulting from the peer review. It also details the commendations as well as recommendations for follow-up actions. NVAO takes its decision about the distinctive feature based on this report. The NVAO also advises the Minister of Education, Culture and Science.

The report will be published on NVAO's website www.nvao.net. There you can also find more information about the procedure pertaining to the distinctive feature of 'Small-scale and intensive education'.

2   Programme

2.1   General data

Institution	Breda University of Applied Sciences
Programme	Applied Data Science & Artificial Intelligence
Variant	Fulltime
Degree	Bachelor of Science
Location	Breda
Study load	240 EC[1]
Field of study	Technology (Techniek)

2.2   Profile

The bachelor Applied Data Science & Artificial Intelligence (ADS&AI) educates professionals who understand business processes, know the possibilities of data & AI, and can implement digital transformations, including implementing technology. During the programme, students participate in multiple real-life projects and specialise both in one of the Breda University of Applied Sciences' domains and in a specific ADS&AI role. The programme applies a small-scale and personal approach and has strong connections with industry partners. Extracurricular activities support the professional and personal development of students.

The programme is offered by the Academy for Artificial Intelligence, Games and Media, part of Breda University of Applied Sciences. So far, it has run for two academic years: one year as a track within the bachelor's programme Creative Media and Game Technologies and as of the academic year 2022-2023 as an independent bachelor's programme.

2.3   Panel

Peer experts
- Joep C. de Jong *(panel chair)*, lecturer Business Transformation at Hotelschool The Hague (the Netherlands), lecturer Appreciative Inquiry Certification Programme at the David L. Cooperrider Center of Champlain College (USA) and guest lecturer Entrepreneurship & Appreciative Inquiry at ESCP (Germany);
- Sergey Patsko, Vice President Custom AI Solutions at Capgemini, Amsterdam;
- Margot Winters, master student Aerospace Engineering, TU Delft.

Assisting staff
- Anne Martens MA, secretary;
- Jona Rovers, NVAO policy advisor and process coordinator.

Site visit
Breda, 7 June 2023

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[1] European Credits

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3   Outcome

The NVAO approved panel reaches a positive conclusion regarding the allocation of the distinctive feature 'Small-scale and intensive education' to the bachelor programme Applied Data Science & Artificial Intelligence (ADS&AI) offered by Breda University of Applied Sciences (BUas). The education programme meets all criteria of the criteria pertaining to distinctive feature of "Small-scale and intensive education, 2018".

ADS&AI students gain in-depth knowledge and skills in AI, analytics, data science techniques, business and process design, change management, and AI ethics. The programme emphasises the importance of personal development and an attitude of continuous learning to be able to adapt to yet unknown changes in the discipline. Students both gain a broad knowledge base and specialise in one of the BUas domains and in a specific ADS&AI role. This likely leads to high level graduates.

The curriculum has a well-thought-out structure, based on project-based education and workshops for knowledge and skills training. It applies a gradual increase in complexity and responsibility for individual development, creating self-directing and self-responsible professionals. Several extracurricular activities that support the achievement of the intended learning outcomes, challenge students and contribute to the formation of a learning community.

The panel is impressed by the programme's small-scale and intensive learning environment, which reflects professional practice and prepares students well for their future careers. From the start of the programme, students work with projects and data from the field, requiring them to apply the skills they have learnt and giving them valuable experience in working with real (and polluted) data sets. This challenges students to become problem solvers and stimulates them to 'learn to learn'. The programme ensures continuous student-staff interaction and has strong ties with different industries. In addition, an intake procedure supports the selection of suitable students.

The panel is positive about the core team of lecturers. They are qualified and highly committed to the personal development and wellbeing of their students. The project-based approach requires lecturers to be very involved in the programme, supervising students and providing feedback regularly. The programme's facilities are adequate for the organisation of small-scale and intensive education. The IT infrastructure is fitting for a programme on ADS&AI. The digital learning facilities also support the extracurricular activities and a deep dive into AI topics.

Based on these considerations, the panel advises to award the distinctive feature 'Small-scale and intensive education'.

Criterion	Judgement
A. Intended learning outcomes	meets the standard
B. Programme: contents	meets the standard
C. Programme: learning environment	meets the standard
D. Intake	meets the standard
E. Staff	meets the standard
F. Facilities	meets the standard
G. Achieved learning outcomes	meets the standard
Conclusion	*Positive*

4   Commendations

The programme is commended for the following features of good practice.

1. Curriculum structure – The curriculum has a well though-out structure with a gradual increase in complexity and responsibility for individual development, creating self-directing and self-responsible professionals.

2. Extracurricular activities – The extracurricular activities support the achievement of the intended learning outcomes, challenge students and contribute to the formation of a learning community.

3. Professional cooperation – The programme has strong links to different industries. Students work with projects and data from the field, requiring them to apply the skills they have learnt and giving them valuable experience in working with real (and polluted) data sets. Lecturers are involved in the discussions with the Advisory Board and thus hear first-hand what is going on in the industry.

4. Lecturers – The programme has a core team of highly committed and qualified lecturers. The programme supports several activities for lecturers to stay up-to-date with the rapid developments in the field of AI.

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5 Recommendations

For further improvement to the programme, the panel recommends a number of follow-up actions. These recommendations don't retract from the positive advise on the distinctive feature.

1. Position – Position AI as a unique differentiator in BUas's programme portfolio. The appointment of an ADS&AI lector may be helpful to position the programme as unique in the field.

2. Intake – Involve lecturers in the intake assessment to strengthen the procedure.

3. Board of Examiners – Add a member with AI expertise to the Board of Examiners.

4. Workload – Monitor workload of the lecturers closely, because of their strong involvement in the programme.

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6 Assessment of distinctive feature

6.1 Criterion A Intended learning outcomes

The objectives and intended learning outcomes are aimed at achieving an above-average level in one or more academic disciplines and/or professional practices in the domain concerned. In addition, the programme focuses on the broadening and development of related personal attitudes and skills.

Judgement
Meets the standard.

Findings, analysis and considerations
The bachelor's programme Applied Data Science & Artificial Intelligence (ADS&AI) as offered by Breda University of Applied Sciences (BUas) intends to deliver young professionals who have a '+' and are ready to make an impact and create a better world. The programme is based on the National Course Profile ADS&AI, which contains a clear presentation of eleven final qualifications for ADS&AI graduates. These are related to four conceptual knowledge areas that are central to the profile of the ADS&AI professional: (1) Project & Change Management, (2) Data Science, (3) Artificial Intelligence, and (4) Digital Transformation. The programme considers it essential that students develop adaptive capacity: they must learn to continuously acquire new competencies to adapt to developments in the field. Additionally, the programme emphasises the importance of quickly becoming familiar with new domains. The information dossier remarks that the competency profile contains a set of knowledge domains that is broader than in other IT bachelor's programmes. In addition, ADS&AI students gain in-depth knowledge and skills in business and process design, change management, and AI ethics.

During the site visit, the panel obtained a clearer picture of the above-average level of the ADS&AI programme at BUas. Students and lecturers illustrated what makes the programme stand out, related to the way the programme interprets the final qualifications. It addresses topics such as data engineering, models development and aspects of overfitting or bias detection, MLOps, solution architecture, DevOps and deployment of AI applications in production. The programme emphasises personal development and the need to 'learn to learn'. The panel acknowledges that students reach a higher level by experiencing various roles and integrating multiple domains. Finally, students specialise both in one of the BUas domains[2] and in a specific role[3].

In summary, the panel is convinced that the programme aims at achieving an above-average level in ADS&AI. Students both gain a broad knowledge base and specialise in at least one BUas domain and an ADS&AI role. In addition, the programme emphasises the need to develop an attitude of continuous learning to be able to adapt to yet unknown changes in the discipline. The panel believes that BUas could strengthen the programme's profile and recommends to position AI as a unique differentiator in its programme portfolio. Additionally, the panel advises to keep an open mind to developments in ADS&AI education and to benchmark the programme with similar programmes abroad. Overall, the panel concludes that the programme meets the standard for criterion A.

6.2 Criterion B Curriculum: contents

The curriculum and the extracurricular activities are inextricably bound. Their contents tie in with the intended level and the broadening as formulated in the intended learning outcomes. Students and staff share responsibility for the organisation of the extracurricular activities.

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[2] Logistics, Built Environment, Media, Games, Leisure, Tourism, Hotel and Facility Management
[3] Data Modeller/Scientist, a Data/AI engineer, and a Data Consultant (Digital Transformation Specialist)

Judgement
Meets the standard.

Findings, analysis and considerations
The programme has been developed using the blueprint of the bachelor's programme Creative Media & Game Technologies. The curriculum has six underlying principles: (1) project-based education as a central activity, supplemented with knowledge and skills training in the first two years, (2) self-responsibility for professional and personal development, (3) flipping-the-classroom, (4) contact moments dedicated to interaction and feedback, (5) working with real-life projects, and (6) challenging students to consider ethical and legal aspects to develop responsible AI and data solutions. The panel established that these principles have been translated adequately into a curriculum with project-based education and workshops for knowledge and skills training. It has a well-thought-out structure, guiding students from working 'within a school environment with real data', via 'within the school environment for and with practice' to 'working in professional practice'.

The programme applies a gradual increase in complexity and responsibility for individual development, creating self-directing and self-responsible professionals. While students work with scripted materials during the first year ('Foundation'), they need to plan their tasks themselves in the second year ('Exploration'). From the third year onwards, they work together with students from other programmes to learn how to cooperate with students from other BUas programmes ('Collaboration') and specialise in a BUas domain and ADS&AI role. During the final year ('Personalisation'), students may follow an exchange programme, a minor, a premaster at an academic university or a second specialisation. They conclude the programme with a graduation project. The panel values the opportunities to create learning paths that meet individual students' needs.

The panel confirms that the practical application of AI in real-life projects leads to a curriculum with above-average contents. All projects adhere to the same project cycle (CRISP-DM), providing an established foundation for curriculum management. Lecturers explained how they keep the contents up-to-date and adjust the curriculum, for instance by offering multiple best-of-breed IT tools and cloud-based platforms that are gaining traction in the AI market. The panel considers this essential for a programme that addresses a rapidly changing field. The panel appreciates the attention given to ethics and sustainability in IT.

The programme offers several extracurricular activities that support the achievement of the intended learning outcomes, challenge students and contribute to the formation of a learning community. BUas has social clubs organised for and by students, related to different interests. During the site visit, students explained that they are supported by lecturers in setting up and running a club. In addition, the programme encourages students to participate in (inter)national competitions, and plans to offer hackatons, 'Guilds' (from year 2 onwards) and 'Cradle' (years 3 and 4). Guilds are learning communities that consist of students of multiple years, who regularly come together because they share an interest, knowledge, or have a query about a particular AI topic, such as Natural Language Processing or Computer Vision. Cradle is an R&D lab dedicated to designing and developing cutting-edge, innovative games and media applications on behalf of the three lectorates of the Academy for Games and Media. This lab will be extended with data and AI research. The panel appreciates that students reflect on the extracurricular activities and how they contribute to their professional and personal development in learning logs.

The panel concludes that the programme meets the standard for criterion B. The curriculum and the extracurricular activities are in line with the intended learning outcomes. They form a coherent whole that challenges students and contribute to professional and personal development. Students and staff cooperate in the organisation of extracurricular activities.

6.3 Criterion C Curriculum: learning environment
The teaching concept is based on a challenging learning environment, education substantiated in a small-scale and intensive manner, and a learning community of students and staff. The small-scale and intense nature of

the education is demonstrated by the level of participation and preparation that is expected from students. The curriculum is structured in such a manner as to ensure nominal study progress by the students, including extracurricular activities.

Judgement
Meets the standard.

Findings, analysis and considerations
The programme strives to offer education that mimics professional life to facilitate an ambitious learning culture, create a rich learning environment and ensure continuous student-staff interaction. The panel appreciates the strong cooperation with different industries. From the start of the programme, students work with projects and data from the field, requiring them to apply the skills they have learnt and giving them valuable experience in working with real (and polluted) data sets. This challenges students to become problem solvers and stimulates them to 'learn to learn'. The rigorous project-based approach, leading to concrete products, distinguishes the BUas programme from other ADS&AI programmes.

Projects are realised in groups of three to six students, supporting the development of personal and communication skills. Throughout the curriculum, students work on at least twelve different projects end-to-end, allowing them to understand the full development cycle and different roles. The programme organises guest lectures and fieldtrips to further strengthen the connection between student and the industry. During the site visit, current students showcased some of their projects, which the panel found challenging and relevant.

The learning environment has a small-scale and intense nature. Students are required to spend two days on campus ('lab days'); combined with introduction lectures, workshops, guilds and digital Q&A sessions, the programme offers at least 19 contact hours per week. The number of contact hours increases as students follow guest lectures and engage in extracurricular activities. Other days are meant for self-study. Current students told the panel that they usually meet on those days, too. They are instructed via Github Classroom and may participate in Q&A sessions via Microsoft Teams. Students are taught to keep track of the expected and actual hours they spend on a task. They confirmed that the programme requires fulltime commitment and that the extracurricular activities support their learning.

The curriculum follows a scrum-based approach, working with sprints and lab days that start with stand-ups in groups of 15 students, chaired by a lecturer. This approach requires students to prepare well and to actively participate in the programme, while also simulating current practices in the professional field. Feedback is a continuous part of the programme. Every week, the project teams review their progress in peer-to-peer sessions. In addition, students have biweekly 1-on-1 meetings with a staff member to receive individual feedback. Lecturers plan more frequent meetings with students who need extra support. The programme's culture, with ample attention for individual development, ensures that students stay on track, while also creating a strong student-staff connection and leading to a steep learning curve.

In line with the curriculum's gradual increase in complexity, the scope and content of feedback change throughout the programme. During the first year ('Guided Development'), students receive the feedback either verbally or in written form, with very concrete feedforward. Students save the feedback, their reflection and responses in learning logs. Year 2 ('Under Supervision') gives students more freedom and initiative, but lecturers periodically check the way students process feedback. In year 3 ('Self-guided Learning'), students alternately receive team feedback and individual feedback. In the final year students demonstrate a professional attitude and behaviour in a complex developmental context.

In conclusion, the panel is impressed by the programme's small-scale and intensive learning environment, which reflects professional practice and prepares students well for their future careers. The projects from industry are challenging and relevant. The gradual increase in complexity and extracurricular activities support students' development. The programme's personal approach ensures that students and lecturers

know each other well and that students can develop skills based on individual interests. The panel issues a positive judgement regarding criterion C.

6.4 Criterion D Intake

The programme has a sound selection procedure in place, aimed at admitting motivated and academically and/or professionally talented students, in which the criteria include suitability for and interest in the small-scale and intensive educational concept, in combination with extracurricular activities.

Judgement
Meets the standard.

Findings, analysis and considerations
The panel supports the programme's intention to limit its intake to 100 students a year to continue offering a small-scale and intensive educational experience. Both students and staff members stressed the importance of a selection procedure to create a motivated, balanced and diverse student population – leading to success during the programme and upon graduation. The programme also considers the procedure an opportunity to thoroughly inform incoming students about expectations in terms of study load, contents, self-responsibility and extracurricular activities.

The current selection procedure consists of multiple components: (1) participation in the National AI Course, (2) a motivation letter, and (3) an (online) interview. All components are assessed on a 100-point scale, leading to a ranking of applicants. The panel appreciates that previous in-depth knowledge of AI is not required. Rather, the programme looks for students who are willing to learn. The panel noted that the National AI Course is rather easy to pass and suggests to replace it with theory and/or a sample project that is discussed during the interview. This may give applicants more concrete insight in whether they are interested in the contents and set-up of the programme, as well as the programme's inherently self-directing and self-responsible learning environment.

Currently, the programme manager handles all applications. During the site visit, the panel learnt that the lecturers have a clear image of what is needed to succeed in the programme, based on their experiences with students. The panel therefore considers it worthwhile to include the lecturers in the intake procedure. The panel also advises to determine the desired distribution over specialisations among graduates, because this may influence the intake criteria.

The panel concludes that the programme has an intake procedure in place that supports the selection of suitable students. The programme offers dispensation to students who cannot afford the tuition fee. According to the panel, the programme meets the standard for criterion D. The panel recommends to involve lecturers in the intake assessment to strengthen the procedure.

6.5 Criterion E Staff

The number of staff is sufficient in terms of providing small-scale and intensive education, substantiating close contact between staff and students, and providing individual counselling to students outside the educational context. The staff demonstrably command the specific expertise and skills required to achieve the objectives of small-scale and intensive education. The programme actively monitors that teachers hold the required qualifications and, if necessary, ensures that teachers are trained in these aspects.

Judgement
Meets the standard.

Findings, analysis and considerations
The panel is positive about the core team of lecturers involved in the ADS&AI programme. They are highly committed to the personal development and wellbeing of their students. The project-based approach requires lecturers to be very involved in the programme, supervising students and providing

feedback regularly. Current students praise their lecturers for their support and availability. At present, the programme has a staff-student ratio of 1:15 and it aims to maintain a ratio of 1:17 in the long term. The panel considers this fitting for the programme's approach to learning. The programme plans to attract more staff members to organise extracurricular activities and create an ambitious learning culture.

BUas recruits staff internationally to create a diverse and competent teaching team. Lecturers should have a relevant master's degree and the panel appreciates the professional experience that some of the teachers bring. The lecturers' backgrounds match the specialisations offered. Several staff members are employed at or run AI development and consultancy firms, which gives them first-hand experience in AI that they can bring to the classroom. Additionally, internal and external specialists provide state-of-the-art knowledge on specific topics. All staff members are required to complete a training on didactics and examination, tailored towards small-scale and intensive education. The panel understood that this course has been very valuable to the lecturers who participated.

The programme supports several activities for lecturers to stay up-to-date with the rapid developments in the field of AI. The panel especially values the additional training courses that have been organised for the team. Lecturers may also attend additional trainings, conferences and participate in an internship at a relevant company. They are also involved in research on relevant topics such as responsible AI via Cradle, PhD and postdoc positions. They indicated that the appointment of an ADS&AI lector would support their own research as well as students' research projects in years 3 and 4. Finally, the panel considers it a strength that lecturers are involved in the discussions with the Advisory Board and thus hear first-hand what is going on in the industry.

According to the panel, the programme has sufficient and well-qualified lecturers who contribute to a small-scale and intensive learning environment. They are in close contact with students and actively support their development. The panel therefore concludes that the programme meets the standard for criterion E. Because of the strong involvement of lecturers in the programme, the panel recommends to closely monitor staff workload.

6.6   Criterion F Facilities

The programme has its own infrastructure with facilities for small-scale and intensive education and common extra-curricular social activities.

Judgement
Meets the standard.

Findings, analysis and considerations
The information dossier and the site visit have given the panel sufficient insight in the programme's facilities. As of the academic year 2023-2024, ADS&AI will have its own floor on the BUas campus. This 'DataLab' offers classrooms, spaces for group work, as well as 120 workspots where students can connect their own devices with BUas's computer screens, keyboards and mice. Staff members may use flexible work spots. The DataLab is modelled after the facilities that are available for the Creative Media and Game Technologies programme and the programme considers them well-equipped. Current students told the panel that they look forward to this new learning space because it will make it easier to study together and to create a stronger learning community across cohorts. The programme manager mentioned that BUas is working on a new building for all programmes related to AI, games and media. The panel advises to involve students in the design of this new building.

In terms of digital facilities, students have access to relevant information via a personal portal that connects all BUas systems. GitHub Classroom is used as the digital learning environment, supplemented with GitHub Repository for storing project deliverables, Jira for agile project management and issue tracking, and Microsoft Teams for storing work logs and learning logs. Dedicated channels are set up for the organisation of extracurricular activities. At the start of the programme, students are taught how to work with these platforms. An online library of learning resources provides the necessary digital

resources, such as lectures, exercises and video tutorials. In addition, students may follow external online courses via Microsoft, LinkedIn, Code Academy and other external parties.

During the site visit, the panel discussed the cloud servers and hardware that are available to students. In addition to common external platforms – which the panel considers important to stay up-to-date with the latest developments – the programme is currently building an on-premises system. This will enable students to work with secured data and allows the programme to show how AI applications can be deployed both on the edge and in the cloud. The panel appreciates this combination. In addition, the programme has invested in state-of-the-art hardware such as a Pepperbot (for Natural Language Processing and Robots in hospitality projects), three NAO-bots (robotics projects), and a Duckietown consisting of 30 self-driving miniature vehicles (computer vision, logistics and mobility projects). It also has a server available to assist in the training of neural networks.

The panel is of the opinion that the programme's facilities are adequate for the organisation of small-scale and intensive education. They enable students to work collaboratively on projects. The BUas campus offers all necessary facilities, including student support, and brings all BUas academies together. The IT infrastructure is fitting for a programme on ADS&AI. The digital learning facilities also support the extracurricular activities and a deep dive into AI topics. The panel concludes that the programme meets the standard for criterion F.

6.7 Criterion G Achieved learning outcomes (assessed prospectively)

The content and the level of the tests and final projects are in line with the level and the broadening as set down in the intended learning outcomes. Graduates are admitted to demanding postgraduate programmes and/or jobs. The success rates are substantially higher than those of other relevant programmes that do not carry the distinctive feature and are at least on a par with other relevant programmes that have been granted this distinctive feature.

Judgement
Meets the standard.

Findings, analysis and considerations
The information dossier lists several expected outcomes of the programme, including high quality final projects, high levels of satisfaction among alumni, graduates who continue careers at top companies and universities, and low drop-out rates. These are attained by means of the project-based learning environment with intensive coaching, strong connection to the industry and real-life projects, a connection to applied research, and active participation in extracurricular activities. The panel spoke with members of an experienced and well-equipped Board of Examiners of the Academy for Games and Media, which safeguards the programme's level.

Based on the curriculum and the learning environment, the panel foresees the achievement of the intended learning outcomes as well as the projects and endeavours they might set their mind to. The panel considers it likely that ADS&AI graduates will have successful careers because of the practical experience they gain throughout the programme and the projects they develop. The embedding of premaster programmes in the curriculum will help students to be admitted to (academic) master's programmes. The strong learning community and intensive contact between students and staff will probably lead to above-average success rates. The panel recommends to add a member with AI expertise to the Board of Examiners. Overall, the panel issues a positive judgement regarding criterion G.

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Abbreviations

ADS&AI   Applied Data Science & Artificial Intelligence

AI   Artificial Intelligence

BUas   Breda University of Applied Sciences

NVAO   Accreditation Organisation of the Netherlands and Flanders ('Nederlands-
            Vlaamse Accreditatieorganisatie')

NVAO