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HEALTHCARE AS A DOMAIN FOR MASTERING THE SKILLS OF PRODUCT DEVELOPMENT

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ABSTRACT
Healthcare is an important focus in our product development institute from the early seventies on. Last decennium every year about 25% of the students graduated on a thesis subject in the medical field.
In 2011 eighteen of the fifty new masters in product development obtained their degree on a "Medic" subject. We highlight four of them: one product in preventive medicine, one in diagnostics and one in the therapeutic domain. The fourth example regards an instrument to support endoscopic assisted hip surgery. For each master thesis a patent search is required and a business model must be delivered.

Keywords: Product development, healthcare

1 INTRODUCTION

Healthcare challenges future product developers, mostly youngsters from 18 to 23, on several aspects.
Primarily: lain people consider the language of medical doctors cryptic at first glance.
An introductory course in human physiology and anthropometry is given in the first bachelor year as step up for applied ergonomics, and helps our students to develop the necessary vocabulary to make basic communication possible in the medical field.
Furthermore: on the "user's" side of the product, in healthcare at least two groups are concerned, namely the patients themselves and the care givers. The latter can further be divided in nurses, physiotherapists, medical specialists etc., which put, based on their specific tasks, eventually different constraints on the product. Contradictions can appear considering comfort for the patient versus comfort for the care giver. Combining those constraints into an over all acceptable solution appeals for a correct methodology and some creativity.
Next to this, the constraints putted forward by local and governmental decision makers for purchasing, financing and/or legislation are very specific and must be taken into account by the product developer.
Finally, the constraints regarding sterilisation and hygiene in general are imperative in every medical practice, especially in a hospital environment, and put supplementary burden on materials and construction.
We focus on a one semester project for the first master year: I-ware, and on the master thesis.

2 I-WARE PROJECTS

The goal of the I-ware project is to keep up with rapid technology changes and to apply them in Innovative Interaction concepts.
In 2010 the I-ware project was called I-Care; the task was to build up visions on how electronic technology can/will influence the way we will/can take care of people and planet in the near future . Students had to reflect on future user's needs, to define a relevant and feasible product idea and to develop this into an innovative concept.
Sixteen groups of three youngsters are formed into a "design studio" to balance their individual skills. Each group establishes its style and identity and comes up as a team with an innovative concept in the care for people and/or planet domain. Starting with a trend mapping, the group looks for "care" applications, chooses an interaction concept, works out user scenario's, and makes trade-offs based on usability test's with foam mock-ups. Progress is evaluated and adjusted weekly by the staff, and feedback is given during two intermediate presentations before the final jury. Deliverables were a trend book, a dossier, a PowerPoint presentation, a poster (700x1000) and a video clip.

One group tried to find a solution for Livestock problems in Africa, the rest proposed feasible solutions for recognized local problems next decade. They all convinced us in a final happening.

Table 1. Project name and short description of the I-Care designs for our future healthcare in the first (out of two) master year Product Development in 2010

Project Name	Description
Livestock Africa	fighting poverty and boosting economy by efficient livestock farming
the 4th dementia	a system to support people with dementia in living their daily life
SOS 112	smartphone application to obtain more efficient emergency services
Benedict	care platform for the re-integration of the homeless
E-link	integrated hard- and software health accessibility and communication
B-Sign	voice controlled navigation; a smartphone application for visually impaired
Go2	mobilizes blind youngsters and integrates them in the youth culture
Playfit	playful approach to childhood obesity
Keep Breathing	learns children with asthma to live with their illness
Senioo	communication tool for seniors that lose their sight recently,
AquaWeb	sensor network detects chemical contamination drinking water in disaster areas
Appoio	pregnancy support for couples where the woman has type 1 diabetes
SitNAV	mobility and safety improvement tool for young wheelchair users
TownTalk	new technology helps deaf and mutes
MonitORAL	transit capsule to monitor pH, T° and time in case of gastrointestinal disorders
Ensemble	personal handheld medical filing and social contact system

3 MASTER THESIS'S IN THE MEDICAL FIELD

In the catalogue of the thesis in product development (1) you find from the seventies on subjects in the medical field. With Philippe Neerman, and Mic Billet as promoters students worked for instance on the ambulance, the first aid workstation or the psycho-social aspects of the hospital bed. From the eighties we remember the ASIMUT anaesthesia project in the operating theatre under supervision of Paul Tahon, where four students made a common analysis and proposed their own newly developed subsystem in collaboration with the university hospitals of Antwerp and Rotterdam.

3.1 How many?

Including the subjects of the running master thesis this year, we end up this century with a database of 222 subjects in the broad medical field, labelled "Medic" in Table 1.

Table 2. Number of graduates and fraction of thesis's situated in healthcare

Year 20	00	01	02	03	04	05	06	07	08	09	10	11	12
Total	55	60	59	71	84	71	57	51	48	58	41	51	55
Medic	13	20	19	27	27	19	12	20	9	14	9	18	15
M/T %	24	33	32	38	32	27	21	39	17	24	22	35	27

The number of students that graduated this century yearly at our institute varies from minimum 41 to maximum 84, median value 57. The median value of the number of students that graduated on a medical subject is 18, minimum 9, maximum 27. This factor three span is reduced when we look at the number of masters in product development graduating on a subject in the medical field relative to the total number graduating that year: minimum 17%, maximum 39%, median 27%.

We learn that about one out of four students finds a challenging situation in the health sciences or accepts a subject that pops up out of the medical field with a question mark to our school as the subject for his or her master thesis.

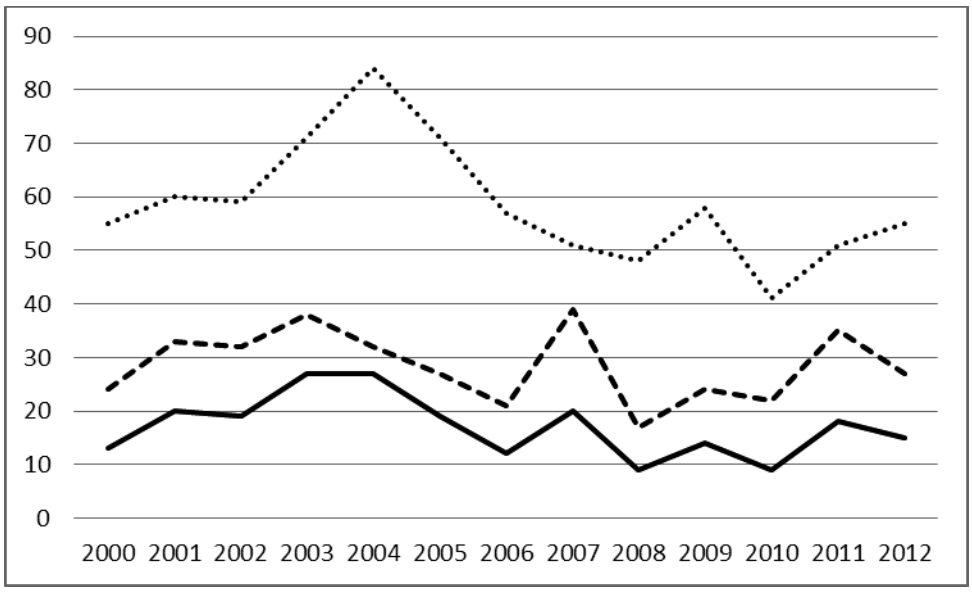

Figure 1. Evolution of the total number of graduates (.....), versus the relative (---%) and absolute (___) number of graduates in the medical field (Medic)

3.2 What?

Looking back into the first seven years of this century, eight groups were distinguished in a selected compilation of 102 abstracts of master thesis's in the medical field bundled in 2008 into the brochure: "Productinnovatie in de gezondheidszorg" for public relation purposes.
The first trio of the eight groups was based on the ABC of the medical act: "A" for prevention, "B" for diagnosis and "C" for treatment.
The remaining quintet was built up of D: products for disaster area medicine, E: products for motoric disabled people, F: products for people with poor eyesight or impaired hearing, G: products for the operation room and the intensive care area, and H: products for medication, nursing and home care.
This post-hoc classification could partly be explained by the enthusiasm of two external promoters from the medical faculty of the University of Antwerp: Luc Beaucourt (2) for disaster area projects, and Victor Claes from the CZT (Centrum voor Zorg Technologie) (3) concerning motoric disabled people.
We decided to maintain this classification today, adding "miscellaneous".

Table 3. Classification of the "Medic" products developed this century at Artesis University College into nine groups(A-I), with absolute (N) and relative (%) frequency of the products within the specified groups

Label	Domain	N	%		Label	Domain	N	%
A	Prevention	40	18,0		F	Eye and Ear	16	7,2
B	Diagnosis	17	7,7		G	Operating & Intensive	14	6,3
C	Therapy	33	14,9		H	Home, Nursing, Drugs	24	10,8
D	Disaster Area	12	5,4		I	Miscellaneous	38	17,1
E	Motoric disabled	28	12,6			Total	222	100,0

3.3 For who?

In which age segments were the intended users situated?
Five dedicated tools were developed for premature child's, fifteen specific for seniors, approximately thirty are intended for kids, one specific for adolescents (MOVI, cfr. infra) and fifty for adults only. The bulk, 120 of the 222 developed products, is "designed for all".

3.4 Where?

As to WHERE the equipment should be used, we found that 40% could not be pinned down to one specific environment, 23% was designed to be used in a typical clinical setting, 13% for an “at home” situation, 7% for a “dedicated environment”, 6% for “on the road”, the remaining is divided in 4% “outside”, 4% is labelled “at work” and 2% “in water”.

4 HIGHLIGHTS OF 2011:

Three examples supporting the ABC of the medical act:

Out of the preventive field: “H2O8, Water Aid” (4), a water purification system for disaster and development areas that provides safe drinking water. The installation was designed in collaboration with Luc Beaucourt, University Antwerp(2), taking the features of the intended user and his environment in mind. H2O8 works critical points away from existing plants by reducing human interaction maximally. The system works on solar energy. Starting from the contaminated water source up to the take-off point of pure water, the whole system is constructed of standard components to minimalise cost. To purify the water new membrane technology is used. Bacteria and viruses are removed by ultra-filtration. The entire system fits during transport on a standard euro pallet.

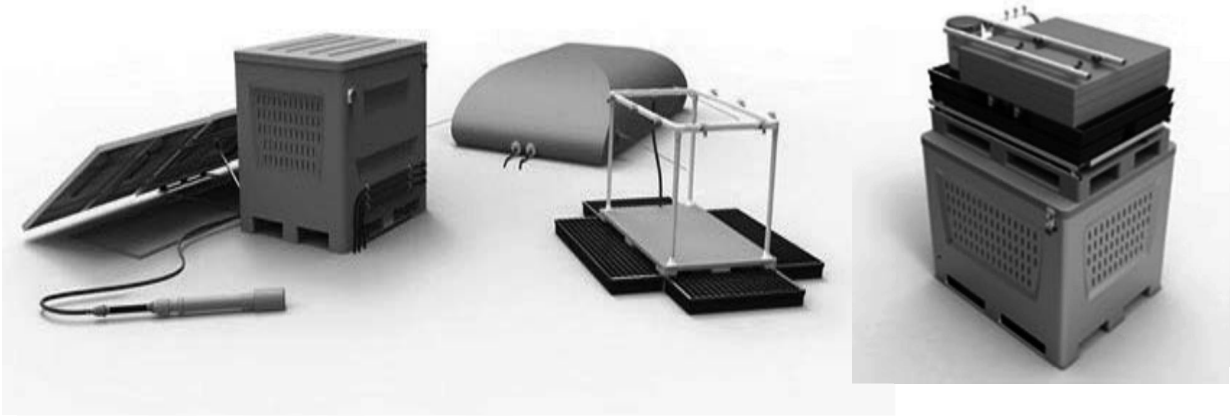

Figure 2. H2O8, Water Aid: complete system, system deployed and system ready to transport

Out of the diagnostic field: “PWV diagnostics” (5), a device to measure pulse wave velocity, indicator of artery stiffness. This is considered a crucial risk factor for cardiovascular diseases. The technology is developed by a European consortium under leadership of Roel Baets, University Ghent (6)

A handheld tool measuring pulse transit time is designed to become “the stethoscope of the future”.

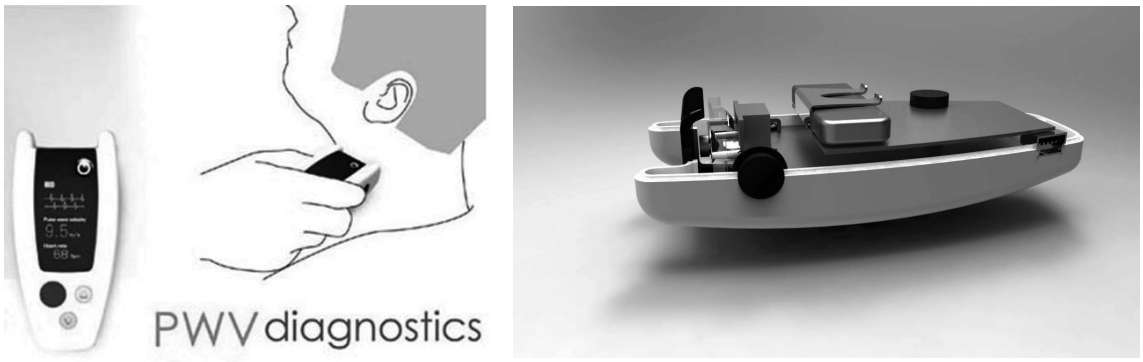

Figure 3. PWV diagnostics: display window, tool in use and mock-up assembly

Out of the therapeutic field: “Movi”(7), designed in collaboration with Antwerp University Hospital and Agfa Health Care to motivate adolescents with cystic fibrosis to maintain their respiratory physiotherapy. The device provides an oscillating column of air to the lungs to loosen and remove the mucus. Movi is used in combination with a smartphone to play a game with another patient, thus supporting their therapy.

Figure 4.Movi: Left exploded view in 3 parts: mouthpiece, rotating opening and electronics; Right: drawing of a possible use situation, with ongoing “battle” on the handheld’s screen

The fourth example is a tool developed on the specifications given by Kris Govaers, orthopedic surgeon, to use during endoscopic assisted hip surgery. The aim is to clamp the frontal end of the endoscope at the femoral neck and enlighten the opened medullary cavity of the diaphysis hands free. The protective cover is a sterile barrier and ensures that the flexible endoscope can not be damaged by the impact of sharp surgical instruments (8).

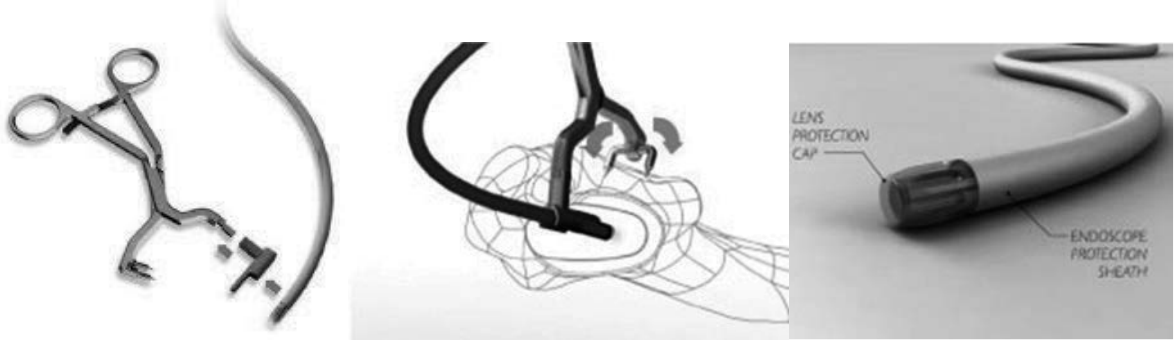

Figure 5. Tool for endoscopic assisted hip surgery; left: fixation clamp with endoscope holder, right: protected endoscope, middle: simulation of use in situ.

5 INTELLECTUAL PROPERTY

It is a standard procedure that the students start with an analysis of the freedom-to-operate of their thesis subject/topic. Legal status, potential threats, key players and related technologies are disclosed. For the extensive worldwide patent search (EU, WIPO, USPTO, JPO, CN, KR, ...) the Espacenet database is used (9).

6 MARKET

Master students have to deliver a business plan in which they describe a business model suitable for the market introduction of their thesis product.
The business models for the medical field should respond to the specific characteristics of the sector:

- Market size (global niche markets)
- Market structure (often monopolistic/oligopolistic markets)
- Stakeholders: very divers (patients, care givers, hospitals, society)

- Financing (often long seed stage which requires considerable pre-financing)
- Needed competences: complex (often need for creating networks and partnerships).

7 CONCLUSIONS

About twenty-five per cent of the students in product development of the Artesis University College graduate yearly on a subject in the medical field, from the primary care up to the university hospital. They are helpful collaborators in our research institutes, and prove hands-on that they are mastering enough the medical jargon to do their job in this field.

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