Technological Support for Positive Education

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Abstract:

The applied computer science programme at Dania Academy of Higher Education's Grenaa department developed a new pedagogical model in the summer of 2013.

This model has significantly reduced student drop-out rates and improved the student grade point average.

The model is based on best practices from the GameWise EU Leonardo project, but shares many aspects of positive education and self-determination theory.

Through a review of major trends in self-determination theory and positive education with special significance put on the model for positive education proposed by Hans Henrik Knoop, the article seeks to provide theoretical underpinnings for this practice.

Based on this, the article proposes a model for quality criteria enabling an analysis of how various technological platforms are deployed to enhance learning. Examples of using of the model hints at its potential as a tool in positive education.

1. Introduction

A small revolution has been brewing for a number of years in the educational world. Little by little, the ideas behind the positive psychology movement has been applied consciously and unconsciously on a pedagogical level at many different levels and institutions in the world of education.

Born out of self-determination theory (SDT), the idea that positive psychology posits at its core is that human beings are characterized by being active and interested creatures, but that certain conditions can stifle this enthusiasm. Predictably, this is of interest to teachers and educators everywhere, since the basic pedagogical need is to create environments that facilitate learning. In recent years, building on a vast number of studies in the educational world, several researchers have created comprehensive models describing how such environments might look like, if they are based in positive psychology and SDT; in short models for positive education.

This article will first briefly review the main findings of SDT, gradually bringing the review closer to the world of education. Then it will detail one model for positive education that builds explicitly on SDT and positive psychology. Following up on this, the article will briefly outline the pedagogical model HAGI introduced at the Grenaa department of the Danish Dania Academy of Higher Education in 2013, showing how it draws on the same principles as positive education models and detailing tangible results. Finally, the HAGI model and the principles covered in the first half of the

article will be synthesized into a model for evaluating technological educational enhancements in positive education, and two commonly used technological enhancements will be briefly analyzed to hint at the analytical potential of the model.

2. Review of self-determination theory

Self-determination theory is an expansion on earlier psychological theories and tendencies that can broadly be defined as a humanistic psychology, whose main proponents were A. H. Maslow (Maslow, 1943) and C. Rogers (1951). Their basic proposition was that human beings have a natural tendency towards growth and development, and that psychology could play a role in detailing environment building and counseling that furthered these tendencies. That is to say that human beings are intrinsically motivated for positive action, and do not need external or extrinsic motivations. The goal of motivational theory should thus not be to construct motivational factors outside the individual, but to remove factors that inhibited the natural, intrinsic motivation of every human being. The means for achieving this was in the view of humanistic psychology simply to create a positive space that allowed these natural tendencies to flourish uninhibited through unconditional positive regard (Deci, Ryan and Guay, 2013).

This should be seen in opposition to theorists who viewed the role of psychology in the positive construction of the self either through behavioristic means (Skinner, 1953) or through facilitating socially constructed identities (Bandura 1986).

In order to effectively argue against behaviorism and social constructivism, theorists in the humanistic psychology tradition drew on studies of early childhood behavior (Harter 1978), flow theory (Csikszementmihalyi 1996) and unique sub-theories created within the movement itself such as CET (Deci and Ryan 1985) to construct a more detailed framework for explaining intrinsic motivation.

A massively influential article by the two main theorists within SDT Richard M. Ryan and Edward L. Deci presented these efforts in collected form in in 2000, which marks the formal formation of the SDT movement (Deci and Ryan 2000a). Here, three basic psychological needs – functionally equivalent to physiological needs for well-being (Hull 1943) – were identified. Autonomy, competence and relatedness.

Autonomy is defined in SDT as “the necessity of experiencing a sense of choice, willingness and volition as one behaves” (Deci, Ryan and Guay 2013). That is to say that any human being must have the experience that she or he acts freely and without coercion from others to have this need fulfilled. This doesn’t mean that autonomy is defined along the lines of individualism, but rather that the individual should experience a sense of free choice in integrating choices that might classically be construed as detrimental to the individual’s own fulfillment of desires (Deci and Ryan 2000a). Being allowed space and support for autonomy in choice, people actually behave in ways that more effectively internalize aspects of the social world (Kernis 2003). It helps them to freely

adopt various rules and customs if they are experiencing autonomy in integrating them in their own value systems.

Competence as a concept has a long history in psychology, and it is classically defined as the desire to interact efficiently with one's environment (White 1959). However, it is classically not identified as a need, but rather as an expectancy or attribution (Bandura 1986), that is to say in essence an external motivator rather than an internal need that must be fulfilled and stimulated in order to achieve intrinsic motivation. However, SDT sees it as critical for understanding competence that it is identified as a need, since this reflects satisfaction human beings find in being able to act on their autonomically chosen values to ensure survival and growth (Deci and Ryan 2000b; Deci, Ryan and Guay 2013).

Finally, relatedness reflects the need to relate closely to other people and communities. Identifying this as a need has been a part of psychological theory across sub-disciplines for many years (e.g. Baumeister and Leary 1995; Bowlby 1969), and SDT basically adopts the mainstream view of relatedness. However, theorists in SDT emphasize the concept of relatedness as crucial in off-setting the potentially destructively individualistic tendencies in the needs for autonomy and competence (Deci and Ryan 2000a; Ryan 1995). They also point out that fulfilling the need for relatedness can apply many of the same methodologies as fulfilling the two other needs, mainly showing this through the effect of unconditional regarding and support of parents with regards to children and their development and interests (Ryan, Deci, Grolnick, and La Guardia 2006).

Creating an environment that satisfies rather than stifles these three needs will nurture intrinsically motivated human beings.

But why would we need intrinsically motivated people, if extrinsically motivated people can do? If students study to get a reward – such as a good grade or a kind word – is the key thing not that they study, and not why they do it?

SDT-guided research has repeatedly shown increased interest, excitement and confidence present in intrinsically motivated human beings, and that these increased levels of positive traits also result in enhanced performance, persistence and creativity (Deci and Ryan 2000a; Deci and Ryan 1995; Sheldon, Ryan, Rawsthorne and Ilardi 1997), self-esteem (Deci and Ryan 1995) and general well-being (Ryan, Deci and Grolnick 1995). Furthermore, the application of extrinsic motivational tools have repeatedly been shown to undermine intrinsic motivation. Specifically relevant to the educational field, numerous studies have shown that students taught with a more controlling approach not only lose initiative, but actually learn less effectively, especially in conceptually oriented topics (Amabile 1996; Grolnick and Ryan 1987; Utman 1997). Furthermore, many typical tools for control have been found to undermine intrinsic motivation quite effectively, for example deadlines (Amabile, DeJong and Lepper 1976), threats of punishment (Deci and Cascio 1972) and negatively framed evaluations (Grolnick and Ryan 1987).

As such, while extrinsic motivation may get the job done, they are a much worse alternative to intrinsic motivation.

However, in an educational context as well as in the broader context of life, many tasks are by definition extrinsically motivated. Furthermore, it is probably utopian to imagine an educational environment that functions entirely without extrinsic motivation. SDT, however, has developed a model for organizing different kinds of extrinsic motivation that highlights the difference between these types. The crucial point is that certain of these types of extrinsic motivations have a far greater potential than other types of being internalized – that is to say of being integrated through an exercise of autonomy as competences, perhaps helped along by feelings of relatedness. In essence, some extrinsic motivations have the potential to function as intrinsic motivations, if they are brought through the process of internalization. (Deci and Ryan 2000a)

The different types of extrinsic motivations are *external regulation, introjected regulation, identified regulation* and *integrated regulation*. (Deci, Ryan and Guay 2013)

External regulation is regulatory attempts at control that are not internalized at all. For example, rewarding a child every time the child solves a page of math problems will result in the child being interested not in math problems, but in the rewards. Similarly, identifying salaries as the main motivation for doing labor will make the laborer more interested in the salary than in the work. As such, if no reward is forthcoming, the activity will cease (Deci and Ryan 1995)

Introjected regulation denotes partially internalized motivation. It is perhaps best understood as the lingering feeling of the sense of self that external regulation engendered along with tangible rewards or punishments. A feeling of pride at having lived up to external expectations or shame at having disappointed them is characteristic of introjected regulation. These feelings are not actually a part of the person's self, but an external attempt at control that lives on even beyond the original, contingent conditions of external regulation. In essence the administration of reward and punishment is outsourced from an authority figure to the person being rewarded or punished (Deci and Ryan, 2000b). In relation to education, research has shown that not only does this form of control not work well on students – teachers who have been subjected to introjected regulation from management also have a tendency to experience burn-out and de-motivation (Fernet, Senécal, Guay, March and Dowson 2008).

Identified regulation is the term for extrinsic motivation that is integrated into a person's own value system and interests. This occurs when behaviors that are essentially extrinsically motivated are nevertheless performed at the same time with a sense of choice and volition. This comes about because it is deeply recognized by the person that not only is there an external authority that wants the individual to perform in a certain way, it is also congruent with the autonomically set goals of the individual to perform in that way (Deci and Ryan 2000b). A good example that research is bearing out as showing positive results of identified regulation is the diabetes patient that not just follows an externally laid plan for taking insulin injections, but recognizes the need for self-regulation as a need that arises from her or his own choice in her or his situation (Austin, Senecal, Guay and Nouwen, 2011). As can be imagined, this type of internalization is a common end goal in the world of education.

Finally, *integrated regulation* is a term that denotes when the individual's values, needs, interests, emotions and other factors are so congruent to the activity that is sought extrinsically motivated, that the individual in essence does not perceive an extrinsic motivation or desire at all (Deci, Ryan and Guay 2013). It is obviously difficult to assess this kind of motivation, since in many instances an individual will not be entirely aware of its relation to extrinsic reward. One way of looking at it is through the lens of talent. If a student happens to be talented at writing papers and enjoys doing this as an activity in and of itself, extrinsic motivations will be essentially superfluous. Similarly, when billionaire Warren Buffet remarks that the market rewards activities he has talents for "disproportionately well", this may be a form of integrated regulation. Formal studies have difficulty showing evidence of this type of regulation, however some studies have shown its occurrence in self-regulated exercise (McLachlan, Spray, Hagger, 2011) and in motivation for seeking psychotherapy (Pelletier, Tuson and Haddad 1997).

Adding to this is a final SDT concept worth investigating, before we try to conclude this review: the concept of *amotivation*. This is defined as the lack of motivation – either intrinsic or effective extrinsic – for a certain behavior, usually leading to doing a job that is not very well done or simply giving up on it (Vansteenkiste, Lens, Dewitte, De Witte and Deci 2004). One very pertinent example is environmentalism, where studies have shown a high risk of amotivation, when individuals feel no control over desired outcomes (autonomy), felt they had no knowledge of effective environmental strategies (competence), and when they simply could not muster enough sense of personal ownership over the environment to do anything (relatedness) (Pelletier, Dion, Tuson and Green-Demers 1999). In the field of education, amotivated students have much higher risk of dropping out (Vallerand, Fortier and Guay 1997). The likelihood of amotivation seems to increase the fewer psychological needs that are met by an activity, further highlighting the need for a focus on intrinsic motivation rather than extrinsic (Ryan and Deci 2011).

As such, SDT uncovers the necessity of creating an environment that can foster intrinsic motivation, or at the very least be conducive to internalization of extrinsic motivation, while at the same time prevent amotivation from occurring. Common to these three goals is creating a need-supportive environment, since the fulfillment of the three basic psychological needs – autonomy, competence and relatedness – are intrinsically linked to obtaining each of the three goals.

How you set about creating such an environment must needs be depend on the context in which you wish to create it. There will be different specific solutions to achieve these principles in a blue-collar factory and in a white-collar open office. Similarly, there are unique implementation strategies for using the principles in the world of education, and our next task is to look at a model for just such a context.

3. Knoop's Model for Positive Education

Building on the foundations of SDT discussed in the previous section, Hans Henrik Knoop has characterized the problems with traditional educational paradigms in the following way:

"So far, education has had three functions. Qualifying young people for life's challenges, socializing young people into cultural traditions, and selection of young people for different working positions available in society. It is strongly debatable how well education has succeeded in overcoming, or better: living up to these tasks, and on can (un-)comfortably argue, that only the last function is fulfilled if ever so unjust." (Knoop 2013)

Elsewhere in the same article, Knoop adds:

"[…] many of the initiatives taken to improve education over the last decades have failed to impress, and have often come at a high price, with many pupils and teacher suffering demotivation, stress, and even depression. Currently, the overwhelming dominating paradigm around the world is one of centralized control over content combined with decentralized economy, predominantly top-down management, monitored through standardized testing, comparative statistics in form of rankings, often sadly tempered by a culture of low trust and a sense of diminishing professional autonomy." (Knoop 2013)

As is plain from these analyses, Knoop identifies the same problems as SDT-driven studies point to: the existing paradigms and organizational infrastructure in the world of education stifles the need fulfillment necessary to ensure motivation and well-being.

When it comes time to formulate an alternative to the dominant paradigm, Knoop draws on the SDT-theorists mentioned above. However, he also incorporates a more comprehensive psychological use of flow theory (Csikszentmihalyi 1993) and even integration of the not typically SDT-associated Albert Bandura (Bandura 1994) – who indeed appears as an opponent in many SDT texts, as hinted above – to formulate the basic tenants necessary for an alternative. It must be based on a student's feeling of self-efficacy – the belief that the student has the capabilities necessary to manage situations that might come up in the course of learning (Bandura 1995) – and that it must promote a sense of play, since the more the students enjoy learning, the more they will learn (Csikszentmihalyi, Abuhamdeh and Nakamura 2005).

This last insight is echoed in abundant research (Anderson, Manoogian and Reznick 1976; Csikszentmihalyi and Rathunde 1993; Deci and Ryan 2000b; Frederickson 2009; Harter 1978; Knoop 2001; Ryan 1995; Shernoff and Hoogstra 2001). It forms the back-bone of Knoop's insistence on focusing on the process of learning rather than the usual metrics of educational success – tests, grades, drop-out rates, employment rates and so on.

Instead, Knoop argues that we should construct fundamentally strength-based educational infrastructures (Knoop 2013). By this he means that instead of building educational infrastructures that aim to expose failures, we should build educational structures that aim to give space for the individual strengths of students to unfold.

In working towards his own model for a strength-based education, Knoop touches base with three other research results, two of them theory complexes and one of them empirical data. First, the Broaden-and-Build theory has shown that positive emotions greatly enhance the potential for learning (Frederickson 2009). Secondly, the mathematical exposure to positivity ratio shows that

because of the negativity bias – humans have a tendency to remember an experience negativity more strongly than positivity – a person needs at least three times as many positive emotions as negative emotions to flourish (Frederickson and Losada 2005).

As such, any educational reform that wants to achieve success must aim to provide a plethora of positive emotions connected to learning, vastly outnumbering the negative ones.

Thirdly, Knoop refers to various online surveys (Knoop 2013) – Clifton Strengths Finder, VIA-IS, Realise2 - pointing out that there is ample materials available and used around the world to try and build positive education (Niemiec 2012). Referring to research into positive education that shows broad principles (Lopez and Louis 2009), Knoop identifies five principles that underlie the strength-based approach to education: measurement, individualization, networking, deliberate application and intentional development. He adds:

"Lopez and Louis argue that through a parallel process, educators practice the principles of strengths-based education when advising and teaching, while students learn to put their strengths to work in learning and social situations. It should be clear how these recommendations are in line with the central elements of self-determination theory, that show how individuals function at optimal levels and are most authentically motivated when three psychological needs are met: competence, autonomy and relatedness." (Knoop 2013)

As such, the aim of positive education is in short to generate situations where teachers can give advice and teach, while students in parallel participate in learning and social situation, all the while grounding these in environments that generate positive emotions. These positive emotions are generated through the instilment of a sense of self-efficacy in teachers and students, so that they can obtain a state of flow. The way to do this is to create environments that satisfy instead of frustrate the three basic psychological needs: autonomy, competence, and relatedness.

As such, when you design educational environments, you should – in the view of Knoop and SDT in general – aim to construct environments resting on those three needs.

Attempting to bring together all the above mentioned, Knoop has constructed a figure that shows the different principles in play[i]:

[insert figure 1]

As is clear from the figure, there are two key concepts from which good educational results, actions and energy result. These are preconditions and experiences.

When you go about aiming to design a positive educational experience, you should therefore focus on creating the necessary structural and infrastructural preconditions that allow teachers and students to have the necessary experiences of positive emotions, engagement, meaning and social relations. For ease of reference, I will below refer to the preconditions in the figure as P1-4, numbered from left to right, and the experiences as E1-4, numbered the same way.

With this map in hand, we'll now move on to describing the HAGI-model used at the Dania Academy of Higher Education and compare the preconditions created by this model to the ideal preconditions described by Knoop.

4. The HAGI-Model at the Dania Academy of Higher Education

The HAGI-model is a result of work done in the EU Leonardo project GameWise Europe[ii], which in 2013 was molded into a pedagogical model at the Dania Academy of Higher Education's department in Grenaa (Lodahl 2014). Here it is used mainly in the Applied Computer Science department that focuses on developing digital games.

The Danish educational system is – broadly speaking – a mixture of two tendencies: a conservative streak that corresponds well to the paradigm described as dominant by Knoop above, and a strong tradition for pedagogical experiments, often with a positive or humanistic psychology bend. Thus, these experiments have often had outcomes that are more in line with the ideas of positive education – that is, heightened ability to deploy autonomy, competence and relatedness – while schools using the conservative approach have tended to produce better results among students who progress in the higher educational system. However, the Dania Academy of Higher Education in a vocationally oriented higher education, and the focus is on educating people ready for the world of work rather than for even further education. Universally, the traditional pedagogical experiments in Denmark have produced people who actually fit better into the world of work, which means that there is fertile ground for pedagogical experiments at institutions such as Dania (Illeris 1992).

HAGI ("Brief presentation", n.d.) is a Danish acronym for

Handling (action)

Artefakt (artifact)

Gennemsigtighed (transparency)

Inklusivitet (inclusivity)

These four words are the principles that the model is built upon. The model focuses on identifying *actions* that can be taken by students and teachers to improve learning situations. These actions and their results are documented through the creation of *artifacts*, both by centering learning in project work that produces complete products – at Dania Grenaa this means creating functioning games – and by controlling the various educational units through documents shared by teachers and students alike; this includes lengthy, written feedback focused on identifying further *actions*. In an effort to ensure complete understanding of the actions and their consequences through *transparency*, clear statements of the expected goals are issued at the start of each educational unit and in preparation for end of term exams. Surrounding these actions and the creation of artifacts, the model cultivates a welcoming and safe space of *inclusivity*, founded not on sanctions and rules, but on creating space for dialogue.

Though the principles have been formulated on the back of practice rather than research, it is clear how they map well with SDT and positive education. Turning first to the three basic psychological needs, the need for *competence* is embodied in identifying *actions* and creating *artifacts*. The need for *autonomy* is catered to by ensuring *transparency*, fostering *inclusivity* and formulating the goals related to the creation of *artifacts* widely enough to allow the students to feel ownership over each project through their own choices. This also underlines a sense of *relatedness* to the work, and the atmosphere of *inclusivity* cultivated at the department props this up as well.

How does the model fit with Knoop's figure above?

P1[iii] partly maps with the principle of *inclusivity* in the focus on creating a good atmosphere – the HAGI model falls short on considering aesthetics and functional settings. P2 is fully covered through the use of autonomy in *action*, the purpose and energy given by working with *artifacts*, the unbureaucratic nature of the clear and *transparent* goals, the flexible degrees of challenge and possibility for concentration afforded by project work, and the non-humiliating feedback at the core of the combination of *inclusivity* and *action*-oriented feedback. The usability and good reasons for doing the work and working with the curriculum highlighted as P3 is ensured by the focus on creating functioning products – *artifacts* – that eventually will be a part of the portfolio aspiring programmers use to apply for positions post-graduation. P4 is ensured through the focus on *inclusivity* and by identifying a vast array of *actions* that are available for the students to facilitate appositive challenges.

E1 is covered by the respect for students inherent in *inclusivity* and *transparency*. E2 is a complex experience that emerges through the combination of the elements in P2 described in the previous paragraph. E3 is achieved through the focus on freely chosen *actions* and the creation of functional, useful *artifacts*. E4 is partially achieved through *inclusivity* and also through the bleeding effect that principle has into the extra-curricular activities of the students such as game nights, Friday afternoon beers and parties.

As such, the model is well underpinned theoretically, but how does it hold up in producing results? If the theory and studies behind positive education is to be believed, the HAGI model should be able to deliver better results even in the terms that traditional education prides itself on: lower drop-out rates, higher grades and better student evaluations.

HAGI delivers on all three points. The drop-out rates of the two first semesters have been slashed from a high 43,75% before HAGI to 7,7% after HAGI. The grade point average has increased from 5,6 to 7,7 on the Danish scale[iv] in the end of term exam on the second semester. Finally, the student approval rate is 90%. (Lodahl 2014).

As such, the experience using technologically enhanced learning in the HAGI model should both reflect a successful use in practice of the technologies involved as well as being a fairly representative picture of the role technological enhancement can play in positive education in general.

Yet, one final step remains before we can look at examples of technology. We have covered positive psychology and the resulting model for positive education as well as a practical example of the use of positive education principles. What remains is to create a general model of quality criteria for using technological enhancement in positive education based on the above theory and experience.

5. Quality Criteria for the Use of Technological Enhancement in Positive Education

Working first with the HAGI-principles, we can assume that a technological enhancement must support at least one of them.

It must somehow enable *action* on the part of the students. Or it must enable the creation, updating or hosting of *artifacts*. Or it should foster a sense of *transparency* through either the ability to conduct quick dialogue or alternatively provide reliable documentational support for well-defined goals. Or it must enable easy dialogue, not add to the burden of student life by adding unnecessary places of interaction, possibly meet the students on platforms where they already are, or in some other way promote *inclusivity*. Any combination is also welcome.

However, the HAGI-model – though comprehensive – failed to incorporated a sense of aesthetics or functional settings from Knoop's model. Thus a category of *enjoyable and easy use* is a factor that should be a part of our quality criteria model.

Finally, to accommodate the background theory of SDT there should be a place for the three psychological needs at the core of that theory somewhere in the model. I therefore propose the following figure as a model for evaluating the quality of tools used in technologically enhanced positive education:

	Relationship to principle	Teacher or student use	Effects on psychological needs
Action			
Artifact			
Transparency			
Inclusivity			
Enjoyability and ease of use			

In accordance with the focus in SDT and positive education on space and positive emotions rather than bureaucracy and negative assessment, a scale is not immediately proposed. It is instead proposed that the use of the model is centered around descriptive evaluation of the tools that are under consideration by a positive education. Do see section 7 below for a discussion of this, though.

6. Examples of the Use of the Model to Evaluate Technology Enhancements at Dania Grenaa

A host of technological enhancements – Fronter, e-mails, Facebook, Twitter, Skype, Dropbox, Trello, SVN, etc. – are used at Dania Grenaa. To demonstrate how the model proposed above can be used to evaluate technological enhancements, two platforms will be evaluated.

At the center of the technological platforms stands Fronter[v] – an LMS platform used by around 8 million people around the world[vi]. Its use is mandatory at the Dania Academy of Higher Education. The model could be filled out like this to describe the platform in relation to Dania Grenaa:

	Relationship to principle	Teacher or student use	Effects on psychological needs
Action	The practice of using Fronter at Dania Grenaa includes the following actions for students: • Checking for messages from teachers • Uploading documents in designated rooms for delivering assignments • Checking comments from teachers on delivered assignments • Checking the schedule • Finding and downloading assigned homework, i.e. pdf files and exercises • Access to local institutional policies and the judicial basis of the education	Both	The need of both teachers and students for competence is catered to by Fronter providing a wealth of information allowing teachers and students to act. For example: which assignments are current? Who has delivered assignments? What is the homework for tomorrow? What is the actionable feedback for my delivered assignment? The need for autonomy is primarily covered for teachers who can themselves control assignments, homework, notes in the schedule, and messages for students. However, they are unable to correct the make-up of the schedule in itself – this needs the involvement of the secretary.

	And for teachers: • Writing messages to individual students or whole classes • Putting homework assignments in the schedule • Designating rooms for assignment delivery • Commenting on delivered assignments • Uploading homework and exercises and organizing these in recognizable patterns related to the schedule[vii] • Accessing institutional policies • Accessing local institutional policies and the judicial basis of the education • Viewing the resources uploaded, described and commented by other teachers		A sense of relatedness is cultivated through the use of a standard and easily recognizable format for posting homework and exercises. This also builds a sense of competence as the students quickly learn to navigate this.
Artifact	Fronter is built around artifacts – documents, schedules, messages – that are handled in the system as objects.	Both	The need for autonomy is satisfied by the posting of self-created artifacts to Fronter – but this is the last part of the chain, and the need satisfaction primarily occurs before

			the involvement of Fronter. The need for competence is given a quick fix by ability to select the correct place to deliver your assignment, but again the main need satisfaction here is located before the actual delivery of the assignment. In many ways, Fronter is a practical necessity for the function of artifact-based learning, but it is not essential as a platform in satisfying the psychological needs involved in artifact creation.
Transparency	Fronter is used as a medium for presenting information. As such it enables transparency. The use of standard formats for presenting this information enabled by the use of a dedicated platform such as Fronter helps further transparency. Fronter is adequate in providing the platform for ensuring transparency, but it not particularly well suited, because of the problems covered below under "Enjoyability and ease of use"	Both	The principle of transparency in itself assures the ability to feel competence and exercise autonomy, and it can build relatedness if applied over time. Fronter provides an adequate platform for this and the mandatory use of it provides the stability that can produce relatedness.
Inclusivity	Fronter operates with e-mail addresses that are	Student	The need for relatedness is covered

	put in by the students themselves for handling messages. At Dania Academy of Higher Education, this means that the students put in a privately held e-mail address rather than getting a new one from the Academy.		by the student getting messages to an e-mail address already used by her or him. The need for autonomy is covered by the student choosing her or his preferred existing e-mail account.
Enjoyability and ease of use	Fronter is designed with an abundance of interaction steps for most actions, making it cumbersome to use. The Fronter at Dania Academy of Higher Education has a local graphic design that focuses on readability and the use of Dania's existing color scheme.	Both	The need for competence and the need for autonomy is partially frustrated because of the unwieldy interaction with Fronter. The need for relatedness could be filled by the use of the color scheme, if this color scheme was more predominant in the everyday experience at the local Grenaa department. However, the department is located in rented space, prohibiting such decoration.

In summation, Fronter is a quite adequate platform for many of the tasks required to support the HAGI-priciples and fill the psychological needs. However, the dimensions of positive education pointed out by Knoop in P1 are not covered well by Fronter. Thus, it is a fair conclusion that while Fronter is adequate in supporting a well thought-out policy of positive education, it does not bring any additions to the table. This makes it a good choice, but not an optimal one.

Dania Grenaa also has a page on Facebook under the colloquial name for the department – Dania Games[viii]. Facebook is a social network used extensively in Denmark – over 3 million of the 5.659.715 Danes are active in a given month (Thaarup and Svenningsen 2015) – and students at the department are natural users. Here is the model applied to this platform:

	Relationship to principle	Teacher or student use	Effects on psychological needs

Action	Facebook as a platform is centered on action. To get updates from the Dania Games page, one must "like" that page. Each update is then a unique post that can be "liked", commented on or shared. The more actions taken involving a post, the more people see the post. As such, users have a plethora of options for actions to undertake, while there are special actions for administrators. The basic administrator act is to post updates, but moderating comments or paying to convert posts into advertisements in the Facebook network can also be undertaken. Users are typically students, former students, partners or guest lecturers.	Both.	To a large degree, Facebook cultivates a feeling of autonomy. As a user or an administrator, you feel able to interact with content as much or as little as you like, and you have several options for any engagement. This experience is located on the surface of interacting with Facebook, however, as is pointed out below under artifact, transparency and inclusivity.
Artifact	Like most digital platforms, Facebook is oriented around artifacts in that posts are conceived of as objects that function in and of themselves – that is as artifacts. However, the posting of posts does not end the editing potential of them, meaning that you can keep rephrasing a post after it has been posted and after users have	Both	If a policy of not editing the posts after they are posted is strictly followed, the same need satisfaction as in producing and showcasing artifacts elsewhere may be achieved. However, if the problem with Facebook's terms of service is raised, a rapid decline in both the feeling of

	engaged with it. This means that the posts cannot in fact be seen as fully functional products that are delivered at a certain time – a key point in HAGI's conception of the artifact principle. There is also the added complication of Facebook's terms of service[ix] that state that content posted to Facebook may be used freely by Facebook. This raises obvious problems of ownership.		competence and relatedness may be expected – since the user or administrator is no longer in command of their artifact creation, and a sense of betrayal from the social network site may be experienced.
Transparency	The proposition of Facebook is that you like a page and then see the posts that page makes in your personal news feed; the list of posts you see, when you log on. This, however is not always applicable, since algorithms behind the scene sort the Facebook feed, leading to dramatic differences in the reach of posts (Constine 2012). This reduces transparency for the administrator and user alike, since neither can be certain that all hear what is said.	Both	A sense of competence and relatedness results from the feeling of being able to see everything posted by the page and being able to reach the connected users. Knowledge of the algorithm may stifle or frustrate this need, however.
Inclusivity	As noted above, around half of the Danish population is regularly on Facebook, which makes it a part of most people's everyday routine.	Both	Relatedness is well served by Facebook, although algorithm complications as noted under transparency

	This ensures that using the platform is seen as natural by the students and administrators alike, heightening inclusivity.		above may be problematic.
Enjoyability and ease of use	Facebook has a responsive, flexible and clear design that heightens both enjoyability and ease of use. Again, the network is already a part of the everyday routine of users and administrators, ensuring this point is covered.	Both	Relatedness and competence are both served well by this dimension of Facebook, through the familiarity and the clear design.

It is difficult to imagine not using Facebook to enhance learning, especially through cultivating relatedness, since so many students are already users of the social network. However, as can be seen from the model above, the sense of autonomy is under constant assault from the algorithms and user terms working behind the scenes. As soon as this need is frustrated, a frustration of the others is not far behind as the model above also maps out.

7. Discussion and possible further research

As the examples above show, there is potential for using the model to evaluate existing technological enhancements in light of positive educational principles. However, several other perspectives present themselves as fruitful areas of research to further qualify the model.

Firstly, while the above examples rudimentarily document the model's value with regards to already adopted technologies, a study that shows the use of the model in evaluating prospective technologies and following up on their usefulness when implemented would demonstrate a higher degree of operationability of the model.

Secondly, the model as it stands is qualitative, not quantitative. As mentioned above, this choice was made to fit into the basic theoretical ideas of SDT and positive education. However, many studies made in the tradition of SDT actually work with scales, quantifying their research (e.g. Fernet, Senécal, Guay, March and Dowson 2008; McLachlan, Spray and Hagger 2011; Pelletier, Tuson and Haddad 1997) so precedence exists in the tradition for constructing quantitatively measurable and comparable outcomes of research. A further development of the model to generate a quantitative ranking of various technological enhancements would ease the use of the model in choosing between different options.

However, a case can be made that there is a limit to how quantifiable you would wish the outcome to be. The use of technological enhancements in a positive educational environment is – as the examples above demonstrate – every bit as complex and multifaceted as the model for positive education is in itself. Reducing this complexity to a ranked list runs the risk of violating parts of P2 of the positive educational model, creating more bureaucracy and less autonomy. To a large degree, it is problematic in a positive educational environment to make models that are effectively able to "do the thinking" for management, as this might promote problematic implementation strategies, since full knowledge of the technical platforms and their relationship to pedagogical practice is made less essential in decision-making by the use of a ranking system. Bluntly put: it is problematic on many levels if the decision to choose the best technological enhancement for a certain pedagogical strategy is reduced to the ability to discern which number is higher.

As such, the model as presented here is useful in organizing thoughts and analysis into actionable summations. It is thus a tool for discussion and information, rather than a model that arrives at a quantified, empirical outcome.

The model can highlight some interesting points through this organization of thoughts, with one particular point contained in the examples above being how the object oriented nature of digital technological enhancements underlines the artifact principle of HAGI, providing a basis for realizing P2, P3, E2, E3 and fulfilling the psychological needs of competence and relatedness. Insights of this nature can help guide further strategic choices when it comes to handling the challenges of digitalization.

Regardless of whether or not you use positive education, it remains an imperative that decisions on technological enhancement is made with first-hand knowledge of its application and use as well as the integrative potential in the pedagogical model used at a given institution. The principles of positive education simply highlight this general fact.

Working within the emerging field of positive education has obvious advantages. As this article demonstrates, in the field of vocational applied science higher education, principles of positive education can effectively and dramatically boost traditional measurement results, and the systematic application of theory can show how to enhance existing educations – technologically or otherwise.

Further research in this area is likewise recommended – for example, the missing coverage of P1-areas in the HAGI-model should be systematically addressed – but the possibilities sketched out here are very encouraging.

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[i] The version presented here is from http://www.strath.ac.uk/media/faculties/hass/conferences/Hans_Henrik_Knoop_Presentation2.pdf, but a version is included in Knoop 2013

[ii] http://game-wise.eu/

[iii] Referring as mentioned above to Precondition 1 in Figure 1. P2-4 refers to preconditions 2-4, while E1-4 refers to experiences 1-4. All numbers are from left to right regardless of horizontal level.

[iv] Corresponding roughly to an increase from 2.35 to 3.15 on the ECTS scale.

[v] http://com.fronter.info/

[vi] http://com.fronter.info/virtual-learning-environment-lms/infographic/

[vii] In the virtual rooms containing homework and exercises, a standard format is followed, indicating which lesson each resource is related to.

[viii] https://www.facebook.com/Daniagames

[ix] https://www.facebook.com/legal/terms