BEME REPORT

THE CONTRIBUTION OF THEORY TO THE DESIGN, DELIVERY AND EVALUATION OF INTERPROFESSIONAL CURRICULA

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ABSTRACT

Background: Interprofessional curricula have often lacked explicit reference to theory despite calls for a more theoretically-informed field that illuminates curricular assumptions and justifies curricular practices.

Aim: To review the contributions of theory to the design, delivery and evaluation of interprofessional curricula

Methods: Four databases were searched (1988-2015). Studies demonstrating explicit and a high quality contribution of theory to the design, delivery or evaluation of interprofessional curricula were included. Data were extracted against a comprehensive framework of curricular activities and a narrative synthesis undertaken.

Results: Ninety-one studies met the inclusion criteria. The majority of studies (86%) originated from the UK, USA and Canada. Theories most commonly underpinned 'learning activities' (47%) and 'evaluation' (54%). Theories of reflective learning, identity formation, and contact hypothesis dominated the field though there are many examples of innovative theoretical contributions.

Conclusions: Theories contribute considerably to the interprofessional field, though many curricular elements remain under-theorised. The literature offers no 'gold standard' theory for interprofessional curricula, rather theoretical selection is contingent upon the curricular component to which theory is to be applied. Theories contributed to interprofessional curricula by explaining, predicting, organising or illuminating social processes embedded in interprofessional curricular assumptions. This review provides guidance how theory might be robustly and appropriately deployed in the design, delivery and evaluation of interprofessional curricula.

PRACTICE POINTS

When selecting and applying theory to interprofessional curricula:

- Differentiate between curriculum design, delivery and evaluation and identify which curricular component(s) require theoretical justification.
- Decide whether the theory will illuminate interprofessional processes, outcomes or both and at which level (individual, group or systems level).
- Match a theory with the focus and purpose of the curriculum design, delivery or evaluation (see Figure 2) and ensure that these theoretical justifications are played out in the subsequent curricular practices.
- Consider a combination of theories if this offers a more fertile or relevant theoretical foundation.
- Explore whether matching the theoretical underpinnings of the curriculum with theory used in its evaluation optimises consistency in the evaluative narrative.
- Apply and articulate theory robustly using principles of theoretical quality.

BACKGROUND

Global changes in the organisation and integration health and social care services has placed demands upon professionals to work together, often in ways that challenge and overlap traditional role boundaries. Despite this, the prevalence of public inquiries into service failures (e.g. DH, 2001; 2003, DE, 2010) has demonstrated that health and social care teams do not always collaborate optimally. Interprofessional education (IPE) – proposed as a means of optimising the delivery of safe, high quality care – brings together different professionals to learn about, from and with one another with the aim of preparing a workforce that is ready for team working (Hammick, 1998; WHO, 2010). Published descriptions and evaluations of IPE curricula often lack reference to a theoretical foundation (Hean et al., 2009; Reeves et al., 2011; Institute of Medicine, 2015). Without engagement with theory, curricula risk offering only partial accounts that ignore assumptions about how and why phenomena occur.

Researchers have attempted to plot the range and extent of theories in use (e.g. Colyer et al., 2006; Hean et al., 2012; 2009; Reeves et al., 2011; Barr 2013; Suter et al. 2013;). Colyer et al. (2006) present a number of case studies from collaborators using or researching theories in several UK-based IPE curricula, whilst Hean et al. (2012) explore some sociological dimensions of interprofessional learning (IPL). Barr (2013) summarises key theories in an overview and moves towards a theoretical framework underpinning IPE. None of these take a systematic approach to searching and synthesising these theories. Where systematic review procedures have been utilised these have either focused upon specific theory types (Hean et al., 2009) or have limited their scoping to studies where learning outcomes have been evaluated (Reeves et al., 2011). Reeves et al. (2007) and Suter et al (2013) report an extensive scoping review of educational and organisational theories, illustrating the range of theories applied to IPE, whilst neglecting the ways in which theory was applied. The review described in this paper consolidates and adds to these scoping reviews by synthesising the pragmatic contributions that high quality theories have made to all elements of curricular design, delivery and evaluation in IPE.

AIM

This review aims to describe the contribution of theory to the design, delivery and evaluation of interprofessional curricula

The objectives are:

- To identify the curricular practices to which theory has contributed;
- To summarise these theories;
- To explain how theories have contributed to these curricular practices.

METHOD

Search strategy and Initial screening

The electronic databases Medline, CINAHL, ERIC and PsychInfo were searched from January 1988 to January 2015, making the review 2 years out of date at the point of final submission. The theoretical sophistication of the area was rapidly expanding at the time of the end of the review, and these date restrictions will have excluded potentially high quality theory use published after the end date of the review. This review however offers a snapshot of a period in time in which IPE moved from a largely atheoretical period to this rapidly expanding and theoretically more sophisticated period. Unlike more traditional reviews of empirical evidence, a snapshot of theory use is acceptable practice, as there is no linear accumulation of evidence surrounding any one phenomenon.

The selection of search terms in the search strategy followed recommendations on systematic reviews for searching theory utilising Booth and Carroll's (2015) *BeHEMoTh* framework (*Be*haviour; *H*ealth condition or context; *Mo*dels or *Th*eories) drawing on comprehensive search terms developed from previous systematic reviews (Colyer et al, 2009; Freeth et al., 2002; Reeves et al., 2011). A total of 3438 citations were retrieved.

The review team searched titles and abstracts for articles that met both of the following criteria:

- *Content relevant to an IPE curriculum:* The broadest definition of curriculum was used to include "…all the activities, all the experiences and all the learning for which an institution or a teacher takes responsibility – either deliberately or by default…." (Fish and Coles, 2005) to account for both planned and unplanned learning. Curriculum could be of any duration and in any setting. An IPE curriculum involved students from two or more professions learning together (WHO, 2010).
- *Contribution of theory*: Aligning to Walker & Avant's (2005) definition of theory, papers were included where a theory or theories were specifically referred to as influencing, predicting, describing, explaining, prescribing, interpreting or organising the design, delivery or evaluation of IPE curricula.

Full details of the initial search strategy and selection criteria are detailed in appendix 1 (appendices available online as supplementary material at https://www.bemecollaboration.org/Published+Reviews/).

Inter-rater reliability was tested on a randomised sample of 408 papers aiming for 80% agreement (Mokkink 2010; McHugh 2012). Where there was disagreement, each member provided justification for their decision-making. Where disagreement persisted, a third review team member mediated the discussion and quality-assessed the controversial paper in order to reach a final decision. A total of 640 papers were taken forward for further assessment of theoretical quality.

Assessment of theoretical quality

The assessment of methodological quality is a core process in selecting papers that report studies of sufficient rigour to constitute good evidence. Where theory is the focus of the review and papers are both empirical and non-empirical in nature, the focus is reframed to assess the theoretical quality with which theory has contributed to curricular processes.

Whilst a number of criterion-referenced frameworks for assessing methodological quality are widely referenced and debated amongst the academy (e.g. Greenhalgh 1997; CASP 2012), there is no criterion-referenced framework available to judge the quality of theory contribution. The review team developed a theoretical quality tool (TQT) to appraise theoretical quality (Hean et al. 2016), adapting the dimensions of theory evaluation proposed by Fawcett (2005) and Fawcett & Downs. Papers demonstrating pragmatic adequacy of theory and accessible articulation of theoretical were included. Appendix 2 provides a worked example. The TQT and procedures for assessing theoretical quality and interrater reliability were piloted by paired reviewers on a sub-sample of 54 papers and as previously described.

Final cross-check and selection

A large number of papers of high theoretical sophistication did not link the theory explicitly to an 'actual' curriculum or curricular process that had 'actually' been implemented. These papers were classified as 'aspirational' – they provided robust theoretical discussions, but without application to curricular practices. These 'aspirational' papers were excluded, leaving a final sample of 91 papers for extraction and synthesis. Figure 1 provides an overview of how the final sample of papers was reached, and appendix 3 references the 91 included studies.

INSERT FIGURE 1 HERE

Data Extraction

Given the review aim of describing and explaining the contribution of theory to the design, delivery and evaluation of interprofessional curricula, every possible component of the curriculum needed to be accounted for. A data extraction tool (available in Appendix 4) was developed to cross-reference curricular components with theoretical contributions The review team's sensitivity with established curricular framings (e.g. Coles and Grant, 1985; WHO, 2010; Thistlethwaite & Moran, 2010; Reeves et al 2011; Phillips et al. 2013, Brandt et al, 2014; Reeves et al, 2016) allowed for the development of a comprehensive and exhaustive extraction tool. The tool was piloted during a 2-day review team workshop to 'practise' extraction.

Evidence Synthesis

The synthesis presented below is a narrative to meet the objectives of the review. The final sample demonstrated considerable heterogeneity which prevented meta-analysis. A framework approach (Pope et al. 2000) applied an *a priori* curricular framing to the narrative synthesis of theories-in-use (Popay et al, 2006). Where relevant, realist principles (Pawson, 2006; Dalkin, 2015) have been integrated into the narrative.

RESULTS

Overview of the sample

Most papers (59/91 (65%)) are written by more than 3 authors suggesting that the theory quality is enhanced when multiple authors collaborate (Table 1). All papers had at least one author affiliated to higher education, with only 14% having a co-author affiliated to a care provider. Almost all papers (86%) were authored in the UK, Canada or USA. This may reflect the English Language inclusion criterion of the sample but also a longer political history of IPE in these countries. Only four papers reported international collaboration. Most author teams are from the same university department. Low levels of international, inter-institutional and inter-departmental collaborations suggest these interactions do not appear to contribute considerably to theoretical fertility in the current evidence base.

TABLE 1 INSERT

Over half of the sample (56%) related to pre-qualifying interprofessional curricula. The dominance of nursing in the sample reflects nursing's place as the majority profession amongst the care workforce. Physicians, social work, occupational therapy and physiotherapy were also well represented.

Components of curricula where theory contributes

Table 3 illustrates how theories have contributed to components of interprofessional curricula. Theories are used most often linked to specific learning activities (47%) and to illuminate assumptions or justify the approach to evaluating an interprofessional curriculum or activity (54%).

Table 2 HERE

TABLE 3 HERE

Table 3 maps theories that have contributed to interprofessional curricular components. The synthesis below explains how these theories have contributed to design, delivery and evaluation of interprofessional curricula.

CURRICULUM DESIGN AND DEVELOPMENT

Planning, management and governance

Six papers provided a theoretical contribution to the planning, management or governance of interprofessional curricula. Sommerfeldt et al (2011) and Dematteo and Reeves (2011) used *Appreciative Inquiry* to manage the activities of curriculum committees responsible for designing clinical units offering practice-based IPE. Appreciative inquiry informed management principles by emphasising the need for a 'safe' working environment for committee members. As a result, individuals charged with designing IPE could share perspectives openly without fear of retribution.

Horder (1996) incorporates concepts of *first and second order change* and *health promotion strategies.* These theories contributed to developing interagency training across partner organisations. IPE was viewed as a form of organisational change and these theories justified

how cultural change (e.g. creating vision and building partnerships) is required before structural are made to promote partnership working.

Hall et al (2013) and Weaver et al (2011) view IPE management processes as consisting of multiple structures and stakeholders interacting in a complex system of nonlinear and unpredictable patterns of organisation. *Complexity theory* made sense of the conditions needed to manage this chaotic, open-ended and emergent learning process between members of steering, planning and management committees. They apply specific conditions for learning within complex systems (e.g. internal diversity in the steering group membership) as guidance to optimize creativity during interactions. Cooper et al (2005) draw parallels with complexity theory when explaining the design and evaluation of complex interprofessional processes. They identify that components IPE interventions and underlying mechanisms will influence interprofessional outcomes in unpredictable ways.

Faculty, facilitator or teacher development

The *contact hypothesis* is combined with *adult learning theory* by Freeman et al (2010) to inform training programmes for IPE facilitators. These theories contribute directly to content of learning as facilitators explore explicitly how these inform the curriculum they will facilitate. But these theories also contribute to the delivery of the facilitator training itself, as facilitators from different professions are brought into contact in a safe environment to learn from one another about the IPE intervention. Facilitators from different professions work towards a common vision and are encouraged to engage with a range of learning approaches to account for the many approaches the will encounter during IPE facilitation. This suggests that faculty benefit from similar interprofessional experiences to those provided for the learners they will facilitate.

Anderson et al (2011) use *cognitive dissonance theory* to underpin facilitator training, using it to explain attitude changes expressed in interviews with neophyte IPE facilitators. They suggest that educators with negative attitudes towards IPE, when asked to facilitate IPE for the first time, can experience dissonance and thus a state of psychological tension. Through involvement in IPE they seek to reduce this inconsistency by changing their cognitions about the programme. Hereby positive and confident educators develop, who are able to lead positive and effective

interprofessional learning. This suggests that IPE facilitators should engage in IPE early and actively if their attitudes towards IPE are to change.

Finally, Colyer (2008) combines the lens of *social identity* with that of *psychosocial transition theory* when evaluating academic staff's engagement in an established pre- registration IPE event. This approach views the move from uniprofessional to interprofessional education as a psychosocial transition, a process of psychological adaptation to a different social world. Colyer uses this framework to interpret staff experiences of implementing IPE and the observed attitudes and behaviours of staff who are either ambivalent or hostile to this intervention. From this theoretical standpoint, interprofessional learning is seen as a compromise of professional identity that precipitates feelings and behaviours associated with loss.

CURRICULUM DELIVERY

Learning Outcomes

Learning outcomes of an IPE programme are often uncritically accepted by curriculum developers and many descriptions of curricula provide no theoretical justification for why particular outcomes were selected. By way of contrast, Baker et al. (2008), Brown et al. (2008), Munoz (2009) and Tataw (2011) draw upon *cultural theory* to inform the development of learning outcomes. They suggest that culture imposes rules that limit the way individuals behave, claiming 'cultural competence' as a necessary interprofessional learning outcome. They put structures in place in the curriculum that foster cultural competence, enabling learners to function in intercultural spaces. Baker et al. (2008) combine this cultural perspective with Durkheim's (1933) notion of the division of labour to highlight the interdependence of health care team members and to encourage learners participating in interprofessional simulations to explicitly identify their shared and complementary competencies with other professions. Similarly, Munoz (2009) combines the concept of cultural competence with a *Developmental Model of Intercultural Sensitivity*. Interprofessional learners are supported to slowly progress along a developmental continuum. This strategy is mirrored by Brown et al. (2008) who use

interprofessional clinical cases that become increasingly medically and culturally diverse as the curriculum progresses.

Choices about learning outcome are increasingly framed by professional standards and competency frameworks but again these often fail to make explicit any recognised theory to defend their inclusion. Exceptionally, Tataw (2011) combines *cultural theory* with the *Health Belief Model*, *Socio-Cognitive theory* and *Open Systems Theory* to form a system of cultural-behavioural concepts. This illuminates the assumptions of a competency framework constituted by interpersonal and communication skills, professionalism and health care systems-based practice domains. Using Open Systems Theory, Tataw indicates how that interprofessional learners require outcomes that look beyond single settings and the health domain to consider wider influences on collaborative practices at individual, organisational and community levels.

This has some overlap with the concept of *situational awareness* utilised by Hall et al (2013). Situational awareness is the sensitivity required to undertake the most appropriate action in a particular situation based on the need, available resources and environment. They use this concept to design activities and assessment strategies that enable learners to engage with interprofessional decision-making and reasoning.

Wilhelmson et al. (2012) provide another example of a theoretically-informed competency framework. *Forslund's Model of professional action* underpins the framework and is integrated with concepts of metacognition and the existing IPE competency frameworks of Bainbridge et al (2010) and CIHC (2010). They construct learning outcomes around reflection on how professional action takes place at various analytical levels and guide learners to reflect on the ethical, theoretical and methodological dimensions of their uniprofessional and interprofessional priorities and actions.

Not all learning outcomes are predetermined, however. Swisher et al. (2010) refer to Eisner's (1985) connections between outcomes and three main dimensions of curriculum: the *'Null', 'Explicit' and 'Implicit' or hidden curriculum.* They differentiate the explicit learning outcomes from the implicit outcomes (such as values and beliefs) and the outcomes lost by what has been

omitted. They indicate that curriculum developers must be aware of how these dimensions lead to both anticipated and unanticipated outcomes for learners.

Learning activities

As shown above, theories have often been combined to enable a theoretical justification for learning outcomes (e.g. cultural competence) to be made, whilst also illuminating the mechanism through which the outcome is achieved (e.g. using developmental models of cultural sensitivity). Theories that explained or illuminated how interprofessional learning activities were designed and delivered are categorised as broadly constructivist or social constructionist (no papers drew explicitly on behaviourist assumptions when applying theory to learning activities) or whether they were deployed to explain intergroup processes or as cognitive tools to facilitate learning.

Constructivist learning theories

Constructivist learning theories propose learners ‘‘construct’’ their own personal knowledge of the world, incorporating new experiences with existing knowledge and experiences to generate new insights. Hughes et al. (2004) use concepts of *assimilation and accommodation w*hen describing a third-year undergraduate online IPE module in which learners revisit and revise initial submissions of group work in an iterative process. Similarly, Hall et al (2013) use concepts from Illeris’ (2003) *tension triangle* that proposes that some tension is required to challenge learners to apply new knowledge transformational ways. Tension is created through role played experiences that motivate learners to alter their situated behaviours.

The principles of *adult learning theory (ALT)* are typically referenced with regard to learning activities in interprofessional curricula (Craddock et al. 2006, Hean et al 2009). However, the constructivist justification for ALT was rarely explained and many papers did not reach the theoretical quality threshold for selection, failing to explain the theory or articulate its application to learning processes. This may, in some cases, have been an artefact of word length restrictions at publication.

Where theoretical articulation and application of ALT met the quality threshold, they were used to justify specific interactive, group-based, reflective learning activities. Principles were operationalised through small group discussion, role play, reflective diary writing, and participation or observation of real and simulated interprofessional practices. Lotrecchiano (2013) emphasise the use of multiple real-life case scenarios to initiate learning, presenting course materials online prior to face to face sessions. Cusack & O'Donoghue (2012) and Lary et al (1997) develop clinical cases for learners to work through together as a team. D'Eon et al. (2010) and Eaton (2004) develop cases linked to HIV/AIDS care; and activities where interprofessional groups of students work with families with children with disabilities; respectively. These real life problem-based learning experiences are used to both promote teamwork and an understanding of the contribution that different professions make in these cases. Cooperative and experiential approaches are also taken by McKee et al., (2013) five features of *cooperative learning theory* are incorporated into their delivery of interprofessional learning. Owen at al. (2014) on the other hand combines principles of reflective and experiential learning with social identity theory and theories of communities of practice by encouraging participants to interact with facilitators and with the members of their interprofessional group. Students engaged in reflective journaling on what was happening in the collaborative experiential learning process and on roles and impacts of their traditional professional identities within these processes.

Some authors use the four stages of *Kolb's (1984) experiential learning cycle* to underpin the experiential interprofessional learning activities they deliver (e.g. McKee et al, 2013; Flynn et al 2012; Kinnair et al 2012; Anderson & Thorpe 2010; Clark 2009; O'Halloran et al 2006; Parsell et al 1998; Howkins & Allison 1997). The experiential learning cycle provides a rationale for learning activities focused upon reflective participation in interprofessional collaboration (Anderson & Thorpe 2010; O'Halloran et al., 2006).

<u>Social constructionist theories</u>

Reflection also plays a key role in learning activities that claim to provide *transformational learning* experiences. Transformational learning is a social constructionist approach to learning

emphasising the importance of social interaction. Included studies provided detailed accounts of how transformational learning is operationalized and embedded, rather than simply describing that it occured. Gupta (2006), for example, uses immersive experiences in a homeless shelter to encourage transformative learning when learners from different professions engage in dialogue with users about social (in)justice. Supervised experiences in the homeless shelter were consolidated with reflective debriefing and time to adjust, so that learners were able to challenge and transform their existing beliefs. Similarly, Blue and colleagues (2010) provided learners with diverse learning opportunities, including extra curricula and social activities. They suggest this provides learners with expanding but recursive opportunities to apply interprofessional teamwork competencies demonstrate professional maturation and transform learner perspectives. Lastly, Charles et al (2010) combine concepts of transformational learning with the *theory of human development*. Applying human development theory to IPE, meant activities were phased to facilitate perspective transformations on a trajectory from novice to mature learner.

Vochon et al. (2013) compares the theoretical assumptions made in interprofessional curriculum activities to *work motivational theories,* proposing that learners evaluate their own collaborative practices and compare these with externally received feedback. Work motivation theories underpinned feedback management strategies enabling learners to integrate internal and external sources of performance evaluation. Mann et al. (2009) combine *socio-cognitive theory*, *social learning theory*, *situated learning/communities of practice* and constructivist approaches to learning. Hence their curriculum places importance on the introduction of interprofessional role modelling, observational learning and the demonstration of collaborative practices by educators and in practice settings. Learning through observation, as well as the development of self-efficacy in the learner, are key components of socio-cognitive theory and these authors include incremental performance attainments to build learners' confidence to collaborate with others during experiential learning opportunities. Stocker et al. (2014), Hegemeier et al. (2014) and Koo et al (2013) underpin their learning activities using these socio cognitive principles. Koo et al (2014) for example, explain how sequential participation in two simulated clinical scenarios enabled learners to apply knowledge at two separate increments to develop collaborative self-efficacy. Fellow students were able to engage in observational learning, watching their peers engage in these two scenarios as interprofessional teams.

Hughes et al. (2004) and Gordon et al (2010) draw on socio-cognitive learning theory to design online learning activities where learners collaboratively critique each other's contributions, adding layers of knowledge to the group's construction of what counts as good quality work. Similarly, Hutchings et al. (2013) describe social constructionist learning, triggered by problem based group work with more knowledgeable others help to move the learner across the *zone of proximal development*.

Lees and Meyer (2011) take an alternative view to social interactions underpinning learning activities. They propose *communities of practice* as a way of creating a social environment where mutual engagement and support promotes effective learning. A 'Community of Practice' proposes that learners learn, make meaning and develop a sense of community during the IPE process through social participation, mutual engagement and joint enterprise. Although more commonly applied retrospectively to inform the evaluation of curriculum (e.g. Lees & Meyer, 2011; Sterrett, 2010), communities of practice offer a recipe for enabling group learning through sharing, engaging and working. King and colleagues (2009) suggest that social networking, combined with face-to-face classroom training, provides a basis for developing effective interprofessional communities of practice, whilst Owen (2014) applies community of practice concepts to the design of a simulated learning environment, videotaped and replayed to participants. By having participants watch the simulation together and identify ways to improve care effectively together, the learning was moved from individual learning to situated team-based learning within a community of practice. Finally, for Mann et al (2009), underpinning learning activities with this theory meant engaging learners in the qualified community of professionals. Learners are seen as legitimate peripheral participants in this community, learning and working initially on the periphery but becoming increasingly involved as a full participant over time, taking on more responsibility and accountability for the community's focused work.

Intergroup processes

Whilst some theories emphasise social interactions between individuals, other theories that place greater emphasis on social interactions are between different groups were also marshalled in the evidence base. Hulme et al. (2009) relate concepts of *hybridity* and *third spaces* to

conceptualise the collaborative learning environment. These concepts contributed to the implementation of action learning sets amongst different professionals engaged in children's services. The sets represent a neutral space where professionals can engage in "real" problem-based learning combined with action research with professions from different organisations to develop new knowledge free of the baggage of their home institution.

The composition of the hybrid space is considered by Hall et al (2013) when they apply the concept of *knot working* to their learning activities ensuring that all voices in the "knot" of loosely-connected actors are heard within the learning experience. They stress the importance of small groups working on complex issues that require multiple perspectives to be appropriately addressed. As situations evolve, the knot constantly shifts requiring rapid modifications of relationships between participants. Knot working emphasises the importance of patients and their families as equal and active members of the healthcare team "knot," rather than being passive recipients of care.

Some theories suggest the necessary conditions required for learning. The *contact hypothesis* is one such theory and is one of the most popularly cited theories in the sample. The contact hypothesis has been used in interprofessional curriculum evaluation to defend the choice of outcome measure (e.g. attitudinal change). There are examples of where it has been used to structure the development of the interprofessional learning activities too. Parsell and colleagues (1998) draw on ALT and the contact hypothesis to suggest that learning environments in IPE need to privde learners with emotional and physical safety. Similarly, Watkin (2009) gave interprofessional teams the opportunity to explore each other's professional roles in an atmosphere that fosters mutual respect and trust and where each individual's contribution is valued. Like Parsell, they recognize this as compatible with the principles of ALT which emphasises that learning must be relevant, have intrinsic value and take place in a safe environment. This was achieved through careful facilitation and trust-based icebreaker activities.

Carpenter (1995a) and Carpenter & Hewstone (1996) report carefully structuring their interprofessional learning activities so learners could engage in cooperative interactions. Learners worked together in pairs planning their approach to a case, and then in groups

explaining and discussing their respective roles. Contribution to group success was emphasised throughout as learners were representing their respective professions. Group leaders encouraged comparison and feedback on ideas presented by other learners. The success of the approach was also attributed to the institutional support of senior staff, as the learning was perceived as valuable to the organisation. Each group was given information about the others' educational backgrounds and told that all participants were in the final year of their professional training (implying equal status in the programme).

Other theories that place emphasis on the social interactions of different stakeholders, include *Cultural Historical Activity Theory* (CHAT) and related concepts of *expansive learning*, and *boundary crossing*. For example, Meyer and Lees (2013) show how CHAT can be applied to the learning activities and evaluation of a continuing professional development programme to develop interprofessional learning and collaborative practice across children's services. These workshops provide a forum where conflicts are shared and differing professional perspectives (which in normal working life often remain 'implicit') are voiced and discussed explicitly. Addressing such issues was a means of encouraging expansive learning and new "expanded" ways of interagency working.

Theories used as cognitive tools to facilitate learning

Learners can also benefit from using theory explicitly as a cognitive tool to guide their thinking. Daniels et al (2007) and Martin et al (2008) used CHAT to design and evaluate multiagency workshops; and as a cognitive tool for participants to articulate the dimensions of their own and other agency's activities, identify contradictions within these systems and facilitate the expansive learning required to resolve these challenges. Similarly, Hall et al. (2013) designed learning activities based on the dimensions of CHAT, explicitly for participants to discuss/question each other about the tools and symbols they use in their professions, their roles in their care communities, expectations of each other, and assumed rules of practice.

Alternatively, Stephenson (2004) uses *complexity theory* as a cognitive tool to underpin the content of a workshop on interprofessional clinical reasoning. The theory guides interprofessional groups in their joint exploration of how patient behaviour is part of a complex adaptive system, the sum of multiple influences, each weighted differentially, but that need to

be viewed together and not in isolation. The theory and its application provide an explanatory frame for learners to understand and discuss the influence, weighting and relatedness of their individual contributions to clinical reasoning and holistic interprofessional care.

Anderson et al (2014) use *life course perspective* as a multidimensional lens through which learners conceptualise a case study vertically, in terms of their life trajectory over time, and horizontally in terms of the family, health care team, community, society and environmental situations that interact in the case at any given time. It is used to underpin modular content, exploring the role of health care team members during these different phases of the patient's life, and relationships between team members, patient and family and team dynamics.

Assessment

Theory adequately contributes to interprofessional assessment in just one paper from the sample. Hall et al (2013) describe a formative assessment using Team Observed Structured Clinical Encounters (TOSCE). The assessment strategy used concepts of *idea dominance, knot-working, the tension triangle* and *situational awareness.* The TOSCE introduces tension amongst the loosely-connected team of learners and available resources in the simulated encounter. This motivates learners to generate innovative ideas to deal with the complex and unanticipated situations in simulated assessment.

CURRICULUM EVALUATION

Where theory is more prominently applied in the interprofessional literature is in curriculum evaluation, usually to predict or explain a variety of outcomes, mechanisms and/or contextual conditions related to IPE. In this sample, theory guided the choice of evaluation questions, the scales utilised in surveys, the questions in interview schedules, the application of analytic frameworks, and the interpretation of findings. Theories' contributions to evaluations have been categorised here by their function:

- To explain or predict cognitive or behavioural changes in individual learners;
- To explain or predict the interactions between/within groups;
- To offer a systems-level perspective on IPE and its impacts.

Theories explaining changes in individual learners

As might be expected, evaluations that marshalled theories to explain changes in individual learners focused on learning outcomes. Chan et al (2009) explores theoretical concepts of *caring literacy* and *expanded consciousness* to predict that exposure to IPE increases caring literacy in learners through their learning about different aspects of caring from other professions. This guided their data collection (questionnaire design and interviews), analysis and interpretation. They concluded that learning about caring interprofessionally increased learners' self-awareness of their own and others professional values and expanded their understanding of the meaning of caring.

Bondevik et al (2015) interpreted their analysis of learners' reflective accounts of interprofessional experiences through the lens of *self-determination theory.* Learners self-reported feeling like more autonomous, effective workers, able to regulate their own working and learning. The evaluation argues that feeling respected by other professions during the interprofessional experience enables these effects. Similarly Evans et al. (2014) and Owen et al. (2014) underpin their evaluation with *change commitment theory*, exploring the degree to which IPE led to increased confidence and commitment by participants to engage in collaborative behaviours in practice.

Munoz et al (2009), using the *theory of cultural competence* and the *Developmental Model of Intercultural Sensitivity (DMIS)*, is one of the few examples where both the curriculum's design and its evaluation are informed consistently by the same theoretical constructs. A coherent theoretical narrative facilitates a more sophisticated and convincing justification for the curriculum. Similarly, Brown et al. (2008) use the Inventory for Assessing the Process of Cultural Competence Amongst Health Care Professionals – Revised (IAPCC-R), underpinned by DMIS, to assess changes in students' perceived level of cultural competence following an interprofessional elective course that contained a cultural competence outcomes.

In Lachmann et al.'s (2013) study, the *Four-Channel Model* underpins their evaluation questionnaire, monitoring the emotional response of learners participating in an interprofessional training ward. When the learning balanced learners' sense of increased

competence with an experience of high challenge they achieved an optimum level of immersive, engaged and energised 'flow' in the activity.

Theories explaining interactions between groups

By far the most commonly cited theories used to explain in-group and inter-group interactions were the *contact hypothesis* and variants of *social identity theory*. The contact hypothesis has been frequently marshalled to evaluate and explain intergroup attitudinal change in response to IPE, though there is some variation in the choice of intergroup attitudes that are predicted to change (see Table 4).

TABLE 4 HERE

The contact hypothesis can also direct evaluations to the process by which IPE can bring about change, assessing the conditions of contact required to effect attitude change. Some studies (e.g. Watkin et al 2009; Mandy et al.,2004) focus on outcome alone and do not explore contact conditions. Others (e.g. Ateah et al.2011; Mohaupt et al., 2012; Tunstall et al., 2003) describe how they believe the interprofessional activity has effected positive attitude change by putting in place the required contact conditions; although the extent to which these conditions are present are rarely substantiated empirically. Those that do provide empirical evidence tend not to capture all contact conditions. Bridges & Tomkowiak (2009) and Waterson (2011) assessed the presence of the conditions of equal status and common goals; and equal status, cooperation on common goals and institutional support, respectively. Carpenter & Hewstone (1996) explored learners' initial expectations of the programme and measured the learners' perceptions of the success of joint activity, expectation of programme, institutional support and status of each professional group. Similarly, Barnes et al. (2000) collected learners' ratings on a number of the contact conditions and followed up with qualitative group interviews. In these latter studies, the contact hypothesis is tested more holistically by including both the outcome (stereotype change) and the process (contact conditions) dimensions of the theory in the evaluation design.

Waterson (2011) chose to unpick selected contact conditions in greater depth by complementing the contact hypothesis perspective with that of *social interdependence theory*. They use this theory to expand on the need for intergroup contact to be rooted in successful co-operations between participants from different professional groups. The theory informs an analytical framework that identifies opportunities for giving and receiving help, exchanging resources and information and challenging each other's reasoning in interprofessional activities.

There is a synergy between the contact hypothesis, *social identity theory* and the concept of intergroup differentiation and these theories are often combined in the literature. Evaluators employing these perspectives (Hewstone et al. 1994, Hind et al., 2003; Mandy et al., 2004, Hean et al. 2006; Barnes et al., 2010; Foster and Macleod Clark, 2015) focus on the potential of IPE to promote positive intergroup attitude change through the promotion of 'mutual intergroup differentiation". Learners learn to accept the characteristics on which their professions are different (mutual differentiation) and the characteristics upon which they may compete. The degree to which this takes place is measured empirically by comparing ratings of heterosterotypes (perspectives on other professions) with the stereotypes held of one's own profession (autostereotypes).

Three evaluations applied a social identity lens to their analytic interpretations, exploring the experiences of post-qualified learners exposed previously to IPE (Thomson et al., 2014), peer group IPE facilitators (Clouder et al., 2012) and learner experiences of an interprofessional ward (Lidskog et al., 2008). When taking a social identity perspective, these evaluations demonstrate how interprofessional activities can contribute to learners' professional identity formation, their understanding of the identity of others and their interprofessional identity - or fit - within the wider team. In contrast, Owen et al (2014) hypothesised that collaborative team behaviors can threaten social identities especially if certain responsibilities linked to one's professional identity are relinquished. They assessed the degree to which students perceived other professionals capable of performing a set of specified clinical responsibilities and how this changed before and after an IPE intervention.

Thomson et al. (2015) combine social identity theory with *realistic conflict theory* in their thematic analysis of focus group data. This approach illuminates evidence of different types of professional goals (superordinate, mutually exclusive and interdependent) and their impact on interprofessional conflict and collaboration. Similarly, Simms (2011) uses social identity theory, in combination with concepts of socialisation and professionalism, to explain learning processes during an undergraduate training programme that combined disability and social work disciplines in a new hybrid professional role. They explore how new identities develop, how learners take on knowledge of two separate professions and develop a third new identity through the interprofessional socialisation process. Integrating theoretical concepts in this way can uncover and take account of the uncertainties and ambiguities expressed in interviews with learners engaged in IPE. Similarly, Finneberg et al. (2004) use professional socialization and the concepts of a dual identity of specific professional and team member to underpin their evaluation. They explore this using an "understanding of role" scale, measuring learners' understanding of the roles of physicians and social workers in palliative care and how these two professional roles interact in this context.

Whilst these theories have been invoked to take account of individual changes in learner outcomes (e.g. knowledge, skills, behaviours), other theories were deployed to evaluate the changes in group and community dynamics. For example, Slack and McEwen (2013) build a *community resilience framework* to analyse focus group data evaluating the impact of a community-based IPE programme. Exploring evidence of bridging, bonding and linking *social capital* (as well as economic and human capital) in their data, enabled them to explore the resilience and relationships that had developed in the professional community as a consequence of interactions with learners from other professions. Sterrett (2010; 2015), uses concepts of *social learning* and *communities of practice* to interpret data collected on learners' shared sense of community when participating in an interprofessional fellowship. She explores how learners make meaning of their community through social participation, mutual engagement and joint enterprise engineered by the programme. Lees & Meyer (2011) use communities of practice as a means of both describing and evaluating the experiences of an interprofessional programme for qualified professionals. Their evaluation focuses on the conditions (e.g. good facilitation) that optimise engagement within an interprofessional community of practice and how participants become aligned with community objectives. Hutchings et al (2013) similarly

recognise the importance of engagement with a community of practice, exploring how learners become engaged in legitimate peripheral participation, mediated through interaction with other professions and their social context. They refer to learners' participation in zones of praxis arguing that individuals are more likely to recognise a form of practice (rather than a specified community) and align themselves more closely, or more loosely, with different zones according to their biographical history.

Finally Falk et al (2013) explore the workings of an interprofessional training ward, conceptualised as a community of practice, where identify formation occurs through participation and collective understanding. This is the basis for them surveying students' understanding of their own and others' professional roles, and their ability to collaborate effectively with other professionals. The study also raises important questions about the how multiple factors (such as gender, ethnicity and so on) may impact on professional identity formation in these environments.

Some evaluations focused on the nature and quality of interaction between participants operationalised through detailed analysis of transcribed dialogue between participants. Rowland (2011) used the theory of *coordinated management of meaning* to underpin the analytic framework applied to transcripts of recorded communications between learners collected during a simulation exercise within an acute care hospital. This revealed how members of the interprofessional team engaged in decision making, the instances of uninterrupted monologues in certain professional groups, professions ignoring questions asked by other groups and follow-up of certain content of the dialogue between some professions but not others.

A second approach to evaluating communicative practices draws on the *community of inquiry framework*. Waterson (2011) and Dalley-Hewer et al (2012) used this theory to analyse written communications between learners during online activity looking for evidence, for example, of content questions being asked and answered; and using community of inquiry to underpin a coding framework to monitor the social, cognitive and teaching driven components of communications between learners. Dalley-Hewer (2012) further uses the community of inquiry approach in conjunction with *critical discourse* (Rourke & Kanuka, 2007) to evaluate how the design of e-learning activities impacts on the nature of communication between learner groups.

Critical analysis of instances in which learners present or counter an argument enables evaluation of structural elements that promote certain discussions and conclusions whilst silencing or neglecting others.

Baker et al. (2011) explored the issue of power using the model of *professional closure* on when evaluating an interagency government-funded programme with a range of healthcare organisations that facilitated interprofessional practice-based learning opportunities. Perceptions of relative power held by facilitators, programme leaders and learners demonstrated differentials that directly impacted upon interprofessional learners. Participants deployed closure strategies to make claims on resources and to control working boundaries. More dominant professions sought to control established boundaries of work whilst less dominant professions marshalled interprofessional learning to challenge the status quo, give themselves voice and gain respect. As a result, interprofessional learning serves to perpetuate and redress traditional interprofessional power relationships.

Regan de Bere (2003) uses *Discourse Analytic theory* as a lens to understand the characteristics of interprofessional interactions and explore how certain discourses are privileged, challenged and transformed by IPE. Dematteo and Reeves (2013) explore the thoughts and experiences of learners through the historical lens of a shifting professional discourse and changing cultural and political environments. Smith et al (2015) combined theories of *network governance* and *critical discourse* to analyse a range of text sources (including professional policy documentation and focus group data) to describe the professional discourses of the professions engaging in their post-qualifying IPE programme. They demonstrate how adherence to professional discourses may harm interprofessional teamwork and how illuminating dominant professional discourses may help learners by critical of their own discourse and appreciate and value other professions.

<u>Theories offering systems-level perspectives</u>

Some theories have been used to provide an interpretation of interprofessional curricula as components of complex systems. In these cases theory is used to frame, organise or illuminate interprofessional processes. Falk et al (2013) employ *practice theory* as an interpretive lens to make sense of learners' experiences of an interprofessional training ward. They look beyond individual cognition to account for how experience is mediated by the structures, actions,

interactions and negotiations. They highlight how behaviour is mediated by the physical space (the doings), the words and discourses they draw upon during their interactions (the sayings) and the relationships and interactions they engage in (the relatings).

Reeves and Freeth (2006) use the *presage, process-product model (3P)* as a basis for an analytical framework to manage the many factors an in-service curriculum for community mental health teams. The authors apply these three categories to systematically code data collected from planning meetings and learners' experiences. Swisher et al (2010) use the 3P model to highlight where there may be a theoretical deficit in curriculum design. They suggest the 3P model does not account for organizational factors and proceed to describe their own 'centralised' and 'decentralised' model of interprofessional curriculum implementation and organization to fill this gap.

Meyer and Lees (2013) used Cultural Historical Activity Theory (CHAT) as a lens to interpret the findings of the evaluation of an interprofessional event, finding that pedagogies designed to harness the 'multi-voicedness' of activity systems and the contradictions of multi-disciplinary practice could be used to inspire learning and practice change. CHAT is also used by Daniels et al. (2007) in the design and evaluation of multiagency workshops aimed to highlight the interagency challenges faced by organisations working with at-risk young people. There is close fit here between the theory underpinning both the design of the workshop and the ethnographic research that both informs and evaluates these events. The workshops were designed to direct the attention of participants to the ways in which structural contradictions may be hidden within interagency practices and provide them with activity systems as tools to facilitate their resolution. Qualitative evaluations of these workshops match the theoretical perspectives of the workshops themselves. The ethnography explores how learn to negotiate tensions between rules, tools, objects and identities. Martin et al. (2008) also use CHAT to underpin both the design and ethnographic evaluation of a practice-based curriculum.

Complexity theory is introduced as a cognitive tool into facilitator and learner handbooks by McMurty (2010) to help these stakeholders make sense of interprofessional practice. McMurty (2010) and Cooper et al (2004, 2006, 2009) also use complexity theory in the analysis of stakeholder data to make sense of how knowledge and consensus are developed within a

functioning interprofessional team. Finally, Rodehorst et al (2005) used *diffusion of innovation theory* as an evaluative lens. They emphasise the facets of the social system that are necessary to communicate and implement interprofessional curricula. The study uses concepts of homophily (drawn to similarities) and heterophily (drawn to differences) to examine learners' perceptions of the norms, values and cultures of participating professional groups; and the motivations and hierarchies between participating professions. These dimensions were used to structure focus group discussions, demonstrating the need to account for these structures when planning and implementing interprofessional curricula.

DISCUSSION

This review aims to support interprofessional curriculum designers, educators and evaluators to select and apply theories that can meaningfully contribute to their activities. The wide variation in theories presented implies there is no gold standard theory of choice in the interprofessional field, rather a range of theories are available that may suit the purposes and contexts of users. Previous scoping reviews (e.g. Reeves et al., 2011) located only 20 studies in which theoretical frameworks were described, concluding that such limited use of theory made it difficult to include theory in their conceptual meta-framework describing IPE. Our sample of 91 papers, a reflection of the inclusion of both empirical and non-empirical papers, suggests the field has since become more theoretically fertile. The quality of theory's contribution has improved over time, perhaps coinciding with the emergent recognition of IPE as under-theorised and subsequent calls to provide theoretical justifications for curricular activities (e.g. Reeves and Hean, 2013).

This review evidences that stakeholders select theory contingent on whether it is the design and delivery of IPE (i.e. the planning, management or governance of the curriculum) or the learning experience of IPE itself that is the focus. Where design and delivery are the focus, the curriculum developer will find there are fewer theories in use to choose from, but theories such as appreciate inquiry may be used to manage IPE committees, or psychosocial transition theory can be used to better understand how new facilitators respond to engagement in IPE for the first time.

In contrast, a plethora of theories have been used to underpin the students' experiences of IPE. Together these fall into categories based on whether they explain/predict the outcomes of IPE or the processes by which these outcomes are achieved. Theory also predicts processes/outcomes at individual, group or systems levels of analysis. A number of theories were used to underpin the choice of learning outcome. The learning outcomes described in the review are not the only learning outcomes associated with IPE (Thistlethwaite and Moran, 2010) but are the ones for which a theory has been applied with rigour to defend the focus taken. At an individual level, authors defended their focus on specified learning outcomes such as intergroup attitudes (e.g. contact hypothesis) or competence (e.g. cultural competence). The power of IPE to provide students with knowledge of the wider range of factors, resources or systems that surround their professional practice (e.g. open systems theory), or expand their perspective of a particular clinical dimension (e.g. caring literacy) and engender greater feelings of collaborative efficacy (e.g. socio-cognitive theory) demonstrate the range of theoretical application. Some theory positions explicit individual learning outcomes in relation to other factors such as process and contextual factors (e.g. the 3P model) or highlight the need to take into account both the intended and unintended consequences of an IPE curriculum (null curriculum theory). Social capital theory and community resilience frameworks are the only lenses used in the sample to focus on group level outcomes. IPE designers and evaluators could further explore the wider psychosocial literature for theories to underpin group level and systems level outcomes; whilst recognising that this area is under-theorised and some innovative thinking may be needed to develop it.

Theories have been well utilised to explain the processes by which IPE is thought to have an impact. These largely underpin the design and evaluation of IPE activities and may take a cognitive constructivist approach (e.g. Kolb's experiential learning) focusing on the learning and cognition of the individual. In analysing interprofessional groups, social constructivist approaches are appropriate in which learning or behaviours are seen as mediated by interactions with external factors such as other students or educators (e.g. cooperative learning theory). Some theories highlight that these social interactions are with other professional groups and focus on intergroup processes (e.g. contact hypothesis), whereas others focus on specific dimensions of working with others such as power imbalances (e.g. professional disclosure) or the quality of communication (e.g. community of inquiry).

At a systems level, using theories such as activity systems theory and complexity theory provide a broader overview of the processes at play within an IPE programme and highlight that learning outcomes may be unpredictable and develop expansively as learners work together around a common goal. These provide a framework for understanding the complex and indeterminate nature of IPE, helping IPE developers recognise, or interpret, the multiple confounding influences that play out within and beyond their immediate control.

Descriptions of curriculum design tended to be separate from the descriptions of programme evaluation. Logically, there should be a match between the theory underpinning the programme design and what is subsequently evaluated (Pawson, 2006), although this match is not often evident. This mismatch meant there were insufficient papers that provided enough empirical testing of any one theory, or a comparison of alternatives, to draw valid conclusions regarding whether one theory may be more effective than another. In future, better matching of the theoretical underpinning of curriculum and evaluation would allow conclusions to be drawn about whether or not the theory underpinning the curriculum had led to the proposed outcomes. Munoz et al (2009), Carpenter (1995a) and Daniels et al. (2007) are exceptions to this rule being good examples of theoretical consistency across IPE design and evaluation. These papers deploy respectively, cultural competence, contact theory and activity systems theory across both components. This continuity means evaluation data may then serve to test the theoretical validity of the curriculum design.

The fact that for many papers there was no, or limited, overlap in theoretical underpinnings of the IPE curriculum design and evaluation may simply be a factor of reporting arising from the limited description of the curricula being evaluated in some papers focussing on evaluation (e.g. Ateah et al 2011). This means it is not always clear whether the theory underpinning the original curriculum design matched the evaluation theory being described. In other instances, for example, Cusak et al (2012), the activities of the curriculum are well described but are based on one theory but the outcomes such as learner satisfaction have been evaluated without a clear theoretical underpinning at all; or in O'Halloran et al, (2006) where the curriculum design was underpinned with adult learning theories but the evaluation (Hean et al 2006) underpinned with theories related to intergroup differentiation. This inconsistency may be related to the

curriculum design and evaluation being conducted in isolation, either in terms of who conducts the evaluation or when the evaluation is scheduled. It is not uncommon for the decision to evaluate a curriculum to be made after the curriculum is designed and for researchers not engaged in the original design of the IPE programme, to conduct it. That said, a separation of theoretical frameworks for curriculum evaluation and curriculum design may yield benefits. For example, an alternative theoretical design in the evaluation may uncover the informal or hidden curriculum that had not been the initial intention of the curriculum development team. The outcomes of these evaluations may feed into lessons for the future design and delivery of IPE.

Selection of an adequate theory is not however sufficient when designing IPE curricula and evaluations. The theory must also be well applied. The search strategy located (but excluded) many papers where theory-in-action was clearly recognisable, but had not been articulated clearly or linked it to a specific curricular activity. If papers had mentioned theory, the premise of the theory was often poorly articulated or its contribution or operationalization was unclear. Staff development in 'theoretical awareness' for IPE designers and evaluators is recommended so they are better able to articulate clearly how theory contributes to the shaping of an IPE curriculum.

When reporting IPE curricular interventions and evaluations in the published literature or in curriculum design documentation, authors should be encouraged to:

- articulate the theoretical framework clearly but concisely
- lay out clear propositions derived from the theory
- in the design and reporting of the evaluation, use appropriate methods to derive or test these propositions
- When describing the evaluation and its underpinning theory, clarify, however briefly, the content and theoretical framework of the curriculum being evaluated and the consistency of the theoretical framework with the original curriculum design (see Hean et al. 2016).

Further, some of the more sophisticated curriculum designs (e.g. Hall et al. 2013; Hutchings et al., 2013; Mann et al., 2009; Tataw, 2011) combine a range of theoretical perspectives to

provide theoretical contributions across multiple curricular components and account for processes and outcomes at multiple levels of analysis. These examples of synthesised or meta-theory provide theoretically-rich accounts, though sometimes at the expense of full description of the theory or its demonstrable application in curricular practices. Curriculum designers and evaluators should therefore consider whether drawing upon and integrating multiple theories enhances or confuses the description of curricular processes and justification of curricular decisions.

INSERT FIGURE 2 HERE

LIMITATIONS

Despite our efforts as a review team to minimise individual bias and reach consensus on meaning and assessments made of papers, the review has several limitations. It is possible that variations in reporting and key wording in the literature may have led to some papers being missed. Further, limiting the review to English language will have missed a number of potentially relevant papers written in other languages. We also recognise the bias towards publication of work that reports positive results even when the design of the report is not empirical research.

CONCLUSION

This review has provided a synthesis of a wide range of theories that have been used effectively as tools to structure and defend the components of interprofessional education. There is no single theory that will encompass all they wish to explain/predict and that a range of approaches or a combination of these may need to be taken.

In embarking on the selection of a theoretical framework, curriculum designers, educators and evaluators should distinguish between the curricular components they wish to explore or apply theory to. In identifying whether it is design, delivery or learner experience that is the area of interest, researchers can refine their theoretical selections. Some may prefer to focus on processes, some on outcomes at the level of the individual, the group or the system. When this choice has been made, they may refer to the synthesis presented in Figure 2 to select a theory and refer to its antecedents in the evidence base. Theoretical application should be robust and

useful guidelines are provided by Hean et al (2016).

There is a broad and developing richness of theories available to interprofessional stakeholders to underpin learning activities and evaluation. However, theorists need now to address the components of interprofessional curriculum design and development that are under-theorised. These include curricular governance, facilitator training, assessment strategies. These components are less commonly or robustly defended. It is also encouraged that theoretical perspectives that move beyond individual processes and outcomes are harnessed. Group and systems-level theories may provide the sophisticated theoretical justifications that the interprofessional field requires to propel itself forward.

ONLINE RESOURCES

For online appendices for this review please refer to https://www.bemecollaboration.org/Published+Reviews/

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APPENDIX 1: Search strategy and inclusion/exclusion criteria

Table A1.1: Exemplar of search terms entered into trawling phase of search strategy

	Learning/ education	Interprofessional	Models or Theories
Behaviour (Be)	(curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)		
Health condition/ Context (H)		e.g. (interprofession* OR inter-profession* OR multi profession OR multi-profession*) see appendix 1 for further synonyms)	
Models or theories (MTh)			AB (theor* OR concept* OR framework OR model* OR pedagog*) OR TI (theor* OR concept* OR framework OR model* OR pedagog*)

Table A1.2: Full search terms used in search

	SEARCH 1
S1	AB (theor* OR concept* OR framework OR model* OR pedagog*) OR TI (theor* OR concept* OR framework OR model* OR pedagog*)
S2	AB (Inter-profession* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (Inter-profession*l N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S3	AB (interprofession* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (interprofession* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S4	AB (multiprofession* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (multiprofession* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S5	AB (multi-profession* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (multi-profession*l N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S6	AB (multidisciplin* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (multidisciplin* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S7	AB (multi-disciplin* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (multi-disciplin* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S8	AB (inter-disciplin* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (inter-disciplin* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S9	AB (interdisciplin* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (interdisicplin* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S10	AB (inter-agency* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (inter-agency* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))

S11	AB (interagency* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (interagency* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S12	AB (multi-agency* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (multi-agency* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S13	AB (multiagency* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (multiagency* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S14	AB (multi-occupation* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (multi-occupation* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S15	AB (multioccupation* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (multioccupation* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S16	AB (interoccupation* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (interoccupation* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S17	AB (inter-occupation* N5 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (inter-occupation* N5 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S18	AB (inter-sector* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (inter-sector* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S19	AB (intersector* N5 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (intersector* N5 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S20	AB (multisector* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (multisector* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S21	AB (multi-sector* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (multi-sector* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S22	AB (interorgani?ation* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (interorgani?ation* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S23	AB (inter-organi?ation* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (inter-organi?ation* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S24	AB (interinstit* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (interinstit* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S25	AB (inter-instit* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (inter-instit* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S26	AB (interdepart* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*)) OR TI (interdepart* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))
S27	(AB inter-depart* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*) OR TI inter-depart* N1 (curricul* OR workshop* OR train* OR program* OR learn* OR teach* OR educ* OR course* OR event* OR outcome*))

S28	S2 or S3 or S4 or S5 or S6 or S7 or S8 or S9 or S10 or S11 or S12 or S13 or S14 or S15 or S16 or S17 or S18 or S19 or S20 or S21 or S22 or S23 or S24 or S25 or S26 or S27
	SEARCH 2
S29	(AB contact hypothesis) AND S28
S30	(AB profession* n1 identit*) AND S28
S31	(AB stereotyp*) AND S28
S32	(AU carpenter) AND S28
S33	(TX allport) AND S28
S34	(TX pettigrew) AND S28
S35	(TX hewstone) AND S28
S36	(AU hewstone) AND S28
S37	(AB intergroup n1 differ*) AND S28
S38	(AB inter-group n1 differ*) AND S28
S39	(AB Scaffolding) AND S28
S40	(AB zone n2 proximal n1 develop*) AND S28
S41	(TX Vygotsky) AND S28
S42	(TX Bourdieu) AND S28
S43	(TX Foucault) AND S28
S44	(TX Derrida) AND S28
S45	(TX Freire) AND S28
S46	(AB Social n1 capital) AND S28
S47	(AB Sociocultural) AND S28
S48	(AB Socio-cultural) AND S28
S49	(AB Activity n1 system) AND S28
S50	(TX Engeström) AND S28
S51	(AU Engeström)AND S28
S52	(AB community n2 practice) AND S28
S53	(TX wenger) AND S28
S54	(AB presage) AND S28
S55	(AB ripls) AND S28
	SEARCH 3
S56	(AB Motivational interviewing) AND S28
S57	(AB organi?ational n1 change) AND S28
S58	(AB stages n2 change) AND S28
S59	(AB reasoned n1 action) AND S28
S60	(AB diffusion n2 innovation) AND S28
S61	(AB community n1 organi?ation*) AND S28
S62	(AB social n1 market*) AND S28
S63	(AB proceed n1 precede) AND S28
S64	(AB social n1 ecolog*) AND S28
S65	(AB precaution n1 adoption) AND S28
S66	(AB protection n1 motivation) AND S28
S67	(AB Health n1 belief) AND S28
S68	S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR SS46 OR S47 OR S48 OR S49 OR S50 OR S51 OR S52 OR S53 OR S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S61 OR S62 OR S63 OR S64 OR S65 OR S66 OR S67 English Language, year: 1988-2015
S69	S1 AND S28 LIMIT: English Language, year: 1988-2015
S70	S68 OR S69

Table A.1.3: Summary of Inclusion and Exclusion criteria

Inclusion criteria	Exclusion criteria
Papers describing interprofessional education, training, learning as a planned activity.	Papers describing interprofessional collaboration or practice with no reference to learning or teaching. Papers that explored informal learning experiences between professionals
Papers that reference theory as underpinning one or more components of the curriculum described.	Papers that discuss non-theoretical or technical models and frameworks without explicit alignment to a named theory. Frameworks that have no predictive or explanatory power. There are some frameworks that although lacking theoretical underpinning, still remain useful for IPE curriculum developers and evaluators in terms of consistency of approach to their work.
Empirical and non-empirical article. Given the review aims of describing and explaining the contribution of theory to the design, delivery and evaluation of interprofessional curricula –both empirical and non empirical papers were included.	Theses, monographs, book chapters, policy documents and grey literature
Papers that described theory as deductively applied to, or recognised in, specified curricular processes	Papers that engaged in inductive theory generation.

APPENDIX 2: THEORETICAL QUALITY TOOL (TQT) to assess theoretical quality of each paper (see Hean et al., 2016)

ALL PAPERS	Y=1 N=0	Justification for decision
Paper citation		**Weaver et al. (2011)** Harnessing Complexity Science for Interprofessional Education Development: A Case Study, *JRIPE*
Theory or theories applied		Complexity theory
IS THERE PRAGMATIC ADEQUACY?		
There are clear concrete, feasible suggestions for how the theory proposed can actually be used in designing, delivering or receiving interprofessional curricula (PA).	1	Complexity theory applied to IPE committee members' experience of curriculum design *Complexity theory provides a useful tool not only to understand the experiences of the committee responsible for IPE curriculum design but it also clearly underpins the development of practical guidelines for future interprofessional curriculum development. (p101)* Provides practical suggestions on how to change the way IPE committees can be structured based on this. For example, *The first condition* (of complex systems) *internal diversity, prompted us to more carefully consider the composition of the committee. While several members lauded the diversity present (for example, faculty members, hospital representatives, family members), others pointed to the lack of representatives from the humanities and student groups. It is possible, of course, that a committee can become too large and thus unwieldy or ineffective at getting its tasks completed.* (p116) See guidelines In Table 2 (p117) with practice guidelines based on complexity theory conditions.
The concepts proposed possess relevance to Curriculum on paper/curriculum in action/curriculum received by the learner (Coles & Grant 1985)(PA)	1	Yes, it directly and explicitly informs the development of the curriculum on paper.
Who will find this useful? (PA)	1	Researchers: Provides ways in which researchers can make sense of the experiences of an IPE committee, in which outcomes are complex, unstable and emergent and not linear. Provides the analytical framework for a deductive content analysis of qualitative data. Curriculum designers: Complexity theory underpins guidance of how IPE committees can be run in the future which has pragmatic use for
If answer "yes" to question 1 then proceed to question 2. If answer "no" to question 1 then consider "Not for Detailed Best Evidence Review"		
ALL PAPERS THAT ANSWER "YES" TO QUESTION 1	Y=1 N=0	If "yes", How? If "no", Why?
IS THEORY CLEARLY ARTICULATED?		
Can you easily understand the abstract concepts presented and how they relate to practice? (P, T, PA.)	1	Yes Concept of complex systems is clearly articulated: 3 dimensions and 5 conditions for learning spelt out for a complex system. Each of these are clearly described in detail and then related to the IPE committee. *Our criteria for determining the presence (or absence) of complexity in the curriculum development process involved three key principles characterizing emergent complex systems and five conditions for nurturing learning in such systems…*(p104*)*
Can you understand how the components of the theory relate to one another? (T, P)	1	Yes, they propose that: the IPE committee is a complex system and then distinguish between the principles of complexity theory (e.g. nestedness) and that these five conditions are required for collective learning to take place within a complex system (e.g. decentralsied control).

Are testable/useable propositions derived from the theory clearly presented? (T)	1	Yes, they propose that: the IPE committee is a complex system and therefore using a theory that explains the principles and conditions for learning within a complex system is a relevant framework to use in the analysis of these events. *our intent was to analyse previously recorded experiences of the focus group participants 1) to determine whether the development process can be understood as the unfolding of a complex system and 2) to reflect on how framing participants' experiences in this manner might yield lessons that could be useful for others engaging in similar exploratory, open-ended, interprofessional curriculum development efforts* (p103).
EMPIRICAL PAPERS ONLY	Y=1 N=0	If "yes", How? If "no", Why?
IS THERE EVIDENCE OF OPERATIONAL AND EMPIRICAL ADEQUACY?		
Are theoretical claims tested or used empirically? (EA; T, OA)	1	Yes Focus group data collected and retrospectively analysed using this theory framework. A deductive content analysis of the data was performed. The three principles and five conditions for emergent complex systems served as a predetermined categorization framework for the coding of the data. Clearly spells out principles and conditions of complexity theory. Links these to data collected in focus groups with IPE committee members.
Are the methods of data collection appropriate to test/in the use of the theory or the propositions derived from the theory?(OA)	1	Yes Theory deductively applied. Theoretical framework underpins the approach taken to a content analysis analysis: *One of the authors (LW) first read the quotes, comparing each one against each of the principles and conditions and, if there was a sufficient match, coding each quote accordingly* (p105).
Does the empirical evidence presented confirm the theory or propositions? Is there congruence between the theory and the evidence collected?(EA)	1	Yes. In the analysis of the transcripts, clear evidence is provided that illustrates each of the of the three principles of complexity theories and the stated learning conditions Yes, evidence of the principles and conditions are found within the focus group data. *These principles and conditions are described in greater detail in the Results section, with each presented alongside concrete illustrations drawn from the focus group data* (p104).

Fawcett and Downs' criteria in brackets: Parsimony (P); Testability (T); Operational Adequacy (OA); Empirical Adequacy (EA); Pragmatic Adequacy (PA).

APPENDIX 3: Papers synthesised in the final sample (n=91)

1. Anderson, L.S., Schroth, M., Marcus, M., Becker, C., Pfeil, D., Yngsdal-Krenz, R., Silvis, D., et al. 2 014, The development and implementation of an interdisciplinary on-line academic course using a life course perspective., *Maternal And Child Health Journal*, 18(2): 443–449.
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APPENDIX 4: Data Extraction Template (DET) used as extraction and synthesis framework

PAPER CITATION	
STAKEHOLDERS	
Country (ies) of authors	
Type of institution	
Number of authors	
LEARNING OUTCOMES	
Does the paper describe what participants are expected to learn?	

What are they expected to learn?	
Does a theory underpin what they are expected to learn?	
If yes, list the theories	
Cut and paste the authors' description of each theory	
Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	
LEARNERS	
Does the paper describe the participants/learners	
Who are the participants/learners	
Does a theory underpin the selection of participants/learners?	
If yes, list the theories	
Cut and paste the authors' description of each theory	
Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	
ATTENDANCE	
Is programme attendance compulsory?	
If yes, list the theories	
Cut and paste the authors' description of each theory	
Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	
If yes, list the theories	
LEARNING ACTIVITY (includes method and content)	
Is learning activity described?	
If yes, list the theories	
Cut and paste the authors' description of each theory	
Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	
If yes, list the theories	
Cut and paste the authors' description of each theory	
LOCATION	
Is the location of learning described?	
If yes, how is it described?	
Does a theory underpin the choice of learning environment?	
If yes, list the theories	
Cut and paste the authors' description of each theory	
Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	
If yes, list the theories	
SCHEDULING	
Have scheduling been described?	
If yes, how is it described?	
Does a theory underpin the scheduling strategy used?	
If yes, list the theories	

Cut and paste the authors' description of each theory	
Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	
ASSESSMENT	
Is a formal assessment strategy described?	
If yes, what is the assessment strategy?	
Does a theory underpin the assessment strategy used?	
If yes, list the theories	
Cut and paste the authors' description of each theory	
Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	
If yes, list the theories	
EDUCATORS	
Who are the educators?	
Does a theory underpin the choice of educator?	
If yes, list theories	
Have the educators received training?	
If yes, what are educators expected to learn in training	
Does a theory or theories underpin this learning?	
If yes, list the theories	
Cut and paste the authors' description of each theory	
Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	
Is learning activity described for the educator training?(method and content)	
Does a theory underpin this learning activity?	
If yes, list the theories	
Cut and paste the authors' description of each theory	
Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	
is an assessment strategy included for the educator training?	
If yes, how is it described?	
Does a theory underpin the assessment strategy used?	
If yes, list the theories	
Cut and paste the authors' description of each theory	
Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	
IPE CHAMPIONS	
Are the presence of IPE champions described?	
How is the champion described?	
Does a theory underpin the choice of champion used?	
If yes, list the theories	
Cut and paste the authors' description of each theory	

Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	
INSTITUTION STRUCTURES	
Institutional mechanisms shape the way a team of people work collaboratively, creating synergy instead of fragmentation to develop, implement and deliver IPE. Staff who design or deliver IPE may need clear governance models, structured protocols, communication strategies and shared operating procedures, for example (WHO, 2010)	
Are institutional mechanisms described?	
If yes, how are the institutional mechanisms described?	
Is there a theory that underpins these institutional mechanisms?	
If yes, list the theories	
Cut and paste the authors' description of each theory	
Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	
EVALUATION STUDIES	
Is the course or programme evaluated?	
Does the paper contain primary data to support evaluation?	
If yes, what are the outcomes/processes evaluated in this study?	
Is there a theory that underpins the outcomes or processes evaluated	
Does a theory underpin the choice of outcome/process explored?	
If yes, list the theories	
Cut and paste the authors' description of each theory	
Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	
What is the study design? (overall approach and methods)	
Is there a theory or framework that underpins the study design	
If yes, list the theories	
Cut and paste the authors' description of each theory	
Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	
What are the findings from the evaluation	
Does a theory support the interpretation or synthesis of these findings	
If yes, list the theories	
Cut and paste the authors' description of each theory	
Describe how the theory has been used i.e. How does the theory explain what was done, how it was done and/or why it was done?	